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BULLETIN OF THE ATOMIC SCIENTISTS

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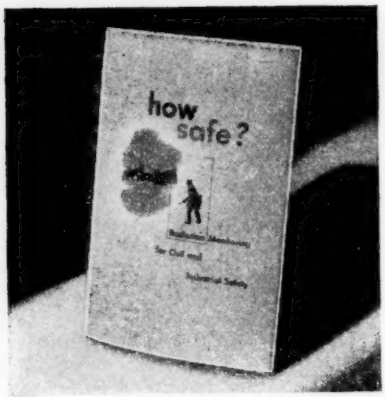

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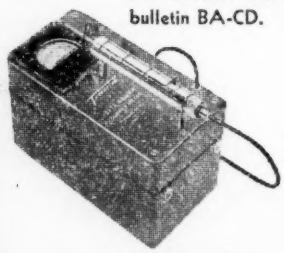

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IMPACT OF THE DEVELOPMENTS IN ATOMIC ENERGY ON THE SCIENCES

EUGENE P. WIGNER

The author of the following article is professor of mathematical physics at Princeton University. He has contributed greatly to the development of uranium reactors, being directly involved in the design of the reactors at Hanford. Dr. Wigner recently received the Franklin Medal of the Franklin Institute for his work in atomic physics.

THE importance of the unhindered and vigorous development of science for technical progress has often been discussed. I wish to deal, on this occasion, with the reverse side of the picture, with the stimulating influence which so many branches of science received from technological accomplishments in the field of atomic energy.

The time to bring up this subject is a particularly propitious one. On December 4, the Atomic Energy Commission declassified the last pieces of scientific information which will enable "any competent group of scientists or engineers" to proceed with the design and construction of nuclear reactors. Few still entertain the enthusiastic attitude of the early days of the Uranium Project, when it was widely believed that the release of this information would be the day for scores of privately owned atomic energy installations to sprout throughout the country. Our nation is too much occupied with tasks of more immediate urgency to permit this and, furthermore, many who were looking forward to such activity have long ago given up waiting and have turned their attention to other matters. In addition, it is to be feared that the astronomical cost of the installations of the Atomic Energy Commission are an effective deterrent. Yet this need not be so. We must realize that a very large part of the high cost of nuclear reactors has been due to the secrecy which had to surround their construction and which, in some cases, necessitated the building of whole new villages to house the builders and operators of the planned reactor. In addition, the emphasis on secrecy and certain other considerations have made the administration of the work on nuclear reactors so difficult that economic considerations had often to be sacrificed. This point is not brought up here as a criticism of past procedures, but as a circumstance which should give the recent release of hitherto secret information more significance than may meet the eye. While it cannot be expected that nuclear reactors will henceforth be standard equipment for our universities and industrial laboratories, some work not wholly financed by the government will begin in the field, and one project has, in fact, already been started. In the absence of secrecy, this work may proceed with greater emphasis on economic considerations and exert an invigorating influence on all atomic energy work in the country. In other words, one may hope that the recent release of information, and further releases to come, will create a more general interest in reactors and their accessories. This broader interest may stimulate a competition in ideas and may stimulate the desire to do better than is done now—the desire which is the basis of American efficiency. It can be hoped, finally, that now that the last element of mystery is removed from them, nuclear reactors, instead of being something to be shied away from, will become one of the instruments to which a scientist is ready to resort in case of need, and will thus increasingly fulfil their function as

Based on an address given at the annual meeting of the American Association for the Advancement of Science at Cleveland, Ohio, on December 28.

tools, and sources of tools, for a great variety of scientific and technical investigations.

This brings us back to our subject proper—the effects of the developments in atomic energy on the sciences. These effects are remarkable not so much because of their spectacular nature as because of their great variety, their extension to so many fields. One cannot point to any single discovery made in the course of atomic energy development, which had as profound an influence on the fundamental concepts of physics as the "Lamb shift"[1]—a discovery made possible by wartime research on radar; but, on the other hand, there are so many fields in which progress was greatly enhanced by the developments in the atomic energy field that it would be impossible to deal with all of them in a short article.

I will attempt to review some of the influence of the developments in nuclear energy on the sciences under four headings: provision of research tools, progress of nuclear physics itself, stimulation of interest in new problems in other fields, and, last, but not least, the effect on the thinking of so many of us on certain fundamental questions of science.

TOOLS FOR RESEARCH

The most important research tools with which large-scale nuclear energy has provided us are unquestionably the radioisotopes. The radioisotope program of the Atomic Energy Commission, originated by a few chemists and biochemists of vision in Oak Ridge, under the leadership of W. E. Cohn, became, under able administration, an institution of more than national importance. It would be quite impossible to enumerate all the research problems in which radioisotopes have been successfully employed or even to mention all the significant scientific results to which they have contributed. Fortunately, this is not necessary because the facts are widely known and there are excellent and comprehensive publications on the subject. Let me simply mention the fact that since the inception of the radioisotope program, in the summer of 1946, the number of shipments of tracer materials to installations outside the Atomic Energy Project has reached almost 20,000 and that the number of investigations in which these tracers have been used runs into the thousands.

The radioisotope program has been supplemented lately by the stable isotope program and by the facilities for neutron irradiation either in one of the reactors or, by means of a photoneutron source,[2] in any properly equipped laboratory.

A very interesting, although not at all typical example of the use of stable isotopes is the investigation, carried out in Los Alamos, of the cause of the "superfluidity"[3] of liquid "helium 2." The London brothers, and other physicists interpreted this phenomenon as the "Bose condensation" of helium. Ordinarily, gases condense at low temperatures because their molecules attract each other. However, as was first shown by Einstein, a gas obeying Bose statistics,[4] such as He 4, should condense even if there were no attraction between its molecules. According to the Londons, this phenomenon must play an important if not decisive role in the conversion of ordinary helium into the superfluid liquid. The London hypothesis could be confirmed by the liquefication of He 3, which is an isotope of ordinary helium. Having an odd mass, He 3 can be expected to obey the Fermi rather than the Bose statistics. The observation that He 3 could not be brought into the superfluid state gave a striking confirmation of the London theory. Further investigations on the properties of mixtures of the two isotopes can be expected to illuminate the mechanism of the phenomenon more closely. Incidentally, this work illustrates our Atomic Energy Commission's interest in pure science. Not only was the necessary stable isotope, He 3, furnished by the commission, but the whole investigation was carried out in one of the Atomic Energy Commission's laboratories.

I may mention in passing another important discovery in the low temperature field which was made possible by the stable isotope program: the isotope effect on the temperature at which certain metals become "superconducting."[5] This discovery reveals quite clearly that this long misunderstood phenomenon is caused by the interaction between the motion of the electrons that carry the electric current, and the vibrations of the crystal lattice of the metal.

As a possible application of irradiation techniques, one may mention the determination of certain impurities in almost unbelievably small quantities. It should be possible, for instance, to determine in this way, with an accuracy of ± 1 per cent in a sample of only a few grams, arsenic in amounts as low as one part in 10^{10}. For most other elements, the accuracy is less spectacular, but still very high, and this includes some cases in which ordinary chemical assay is very difficult. All that is necessary to carry out the analysis is to irradiate the sample by placing it into the reactor for a few hours, remove and dissolve it, add a small amount of a solution containing inactive arsenic as a "carrier," and to precipitate the latter chemically free, as far as possible, from impurities. The active arsenic originally present in the sample, no matter how small its amount, will go into the precipitate along with the inactive arsenic. If the precipitation reaction is suitably chosen, of all the radioactive elements present in the original sample as a result of the irradiation, arsenic alone will be carried into the precipitate. Thus, the radioactivity of the precipitated arsenic will be a direct measure of the amount of this contaminant in the original sample. Unfortunately, neither hydrogen nor oxygen can be determined in solid samples by the irradiation technique. For the determination and tracing of these—which are vital elements in so many applications—one still has to resort to stable isotopes or, in the case of hydrogen, to the new artificial radioactive isotope, tritium.

The production and the preparation for more ready use of the radioisotopes and stable isotopes, along with counters, scalers, etc., has become a veritable industry serving research and development work; several companies specializing in these activities. Instruction in the use of these tools is one of the principal activities of the Oak Ridge Institute of Nuclear Studies.

A very different type of research instrument are the powerful neutron beams which emerge from the shields

[1] Small difference between two sets of levels in the spectrum of the hydrogen atom, whose coincidence was required by the previously accepted theory.

[2] Photoneutrons are neutrons produced by some nuclei during or after irradiation with γ-rays.

[3] Liquid helium exists in two forms—one with the properties of an ordinary liquid, and another "superfluid" one, which shows no cohesion at all.

[4] The kind of statistical treatment to be used, according to theoretical physics, for nuclei consisting of an even number of elementary particles, such as He 4. Fermi statistics is the kind applicable to single protons, neutrons or electrons and nuclei containing an odd number of these particles.

[5] That means, lose their resistance to the passage of an electric current.

of reactors wherever one opens a window. These, of course, cannot be separated from the reactors proper. They can be used for most of the purposes for which X-rays are more commonly used, and for a few others. Their main advantages, as compared with X-rays, stem from the fact that the scattering of neutrons is produced by atomic nuclei, while that of X-rays is caused by the electronic cloud surrounding the nuclei in the atoms. As a result, the neutron-scattering properties of the crystal are almost exactly those of a geometrical point lattice. This permits, in principle, a much more accurate interpretation of the diffraction pattern produced by the scattering of neutrons than is possible for X-rays since, in the latter case, the scattering power is described by the somewhat nebulous concept of "effective electron density." Furthermore, the scattering power of various nuclei differs much less than that of their electronic clouds. It is thus possible, for instance, as Shull and Wollan have shown, to determine, from neutron scattering, the position of hydrogen atoms in a crystal lattice—a task which X-ray crystal analysis was unable to accomplish. It would be impossible in a short article to describe the results of all the interesting experiments which have been carried out with neutron beams and which have greatly enriched our knowledge of crystals. In spite of repeated atempts, even a qualitative demonstration of neutron diffraction was never fully successful before reactors became available as neutron sources. With these new sources, barely seven years old, neutron diffraction is already being used to solve intricate problems of crystal physics, and its use is sure to grow as reactors producing more powerful neutron beams become available to overcome the still troublesome problem of insufficient intensity.

PROGRESS IN NUCLEAR PHYSICS

It certainly is not surprising that work in nuclear physics received a strong impetus from the development of atomic energy, and the reviewer's task in this case must consist of selecting a few of the most important items for discussion. Not all the effects of the discovery of atomic energy were favorable for the development of nuclear physics: the secrecy which had to surround some of the results created some deep gaps in the otherwise coherent structure of our knowledge in the field.

The most important development which nuclear physics owes to the atomic energy program is, in my opinion, the vast amount of numerical data which has been accumulated in the last decade. As compared with our present knowledge of nuclear events, the information available ten years ago consisted of a few scattered data. Bethe and his collaborators, in a well-known series of articles in the *Reviews of Modern Physics,* not only summarized all the accepted theories up to 1937, but also gave a comprehensive and almost complete review of the then available experimental information. Since then, stimulated by the need for materials with specific nuclear characteristics, we have accumulated a great deal of knowledge on radioactivities, excited states of nuclei, their cross-sections, and so on, and the new data are much more reliable and accurate. No well-measured nuclear absorption curve for neutrons in the neighborhood of a nuclear resonance was known before the war; we now have enough to make and verify statistical statements on the density, width, and other characteristics of nuclear resonance levels. The same holds for excited states. It may be true that very few of these data, taken by themselves, are of fundamental significance; but their accumulation has already served to clarify our picture of nuclear structure in at least one fundamental respect: by adducing evidence for the nuclear shell model. Such models had already been proposed before the war; in fact, the "magic" nature of the nucleon numbers 20, 50, 82, etc., had been noticed long ago by V. M. Goldschmidt.[6] However, the scarcity of experimental information did not permit the collection of enough evidence to prove these theories. They remained interesting, but not adequately supported surmises, until a few years ago Mrs. Mayer again brought the idea up, at a time when experimental evidence in its favor piled up almost spontaneously. Her discovery was connected with the development of nuclear energy not only, and perhaps not mainly, because Mrs. Mayer worked in an atomic energy laboratory, but because the material on which she based her conclusions would not have been collected without the practical success of the atomic energy project.

Turning now to a somewhat different example, let us look at the nuclear data just released by the Atomic Energy Commission. The very first of these tells us that for U 235 the usual n-γ reaction, the capture of a slow neutron, is only six times less probable than fission. Since the γ widths in heavy odd elements are known to be smaller than one-tenth of a volt, and since the six times larger probability of fission than of capture indicates that the fission width is only six times greater than the γ width, this must be under 1 eV. The original theoretical estimates had been many times greater. The third item of the same release gives the number of neutrons released per fission as 2.5. Before the war the very existence of fission neutrons (apart from the delayed ones) was doubtful. Examples of this kind, which this single release would permit us to multiply, show not only how important theories have to be adjusted constantly to the growing body of experimental information, they also show how conceptual progress can be limited by the requirements of secrecy. It is certain that, had it been possible to release the above-quoted information at an earlier date, the theory of fission would have been by now more closely adjusted to the experimental facts.

Before leaving the field of nuclear physics, let me mention two important experiments which would not have been possible without operating reactors. The first of these is Wollan's determination of an upper limit to the collision cross-section between neutrinos[7] and heavy nuclei.

Very little information was available on this question before the war—quite naturally so since there were no neutrino sources to speak of. On the other hand, a reactor with only 1,000 kilowatt heat production—a very small reactor indeed—emits a constant stream of 50 kw, that is almost 70 h.p. of neutrinos! There was some apprehension, at one time, that these neutrinos might constitute a danger to the operating personnel. Wollan's measurement, which gave us an upper limit 2×10^{-30} cm^2 for the collison cross-section between a neutrino and a proton, in addition to being of con-

[6] "Magic numbers" are numbers of protons or neutrons at which the stability of the nuclei changes suddenly. In analogy to Bohr's theory of the periodic table of elements, these numbers are supposed to correspond to the completion of "closed shells" of protons or neutrons in the nucleus; the beginning of a new shell is marked by relative instability of the nuclei which follow the "magic ones."

[7] Neutrinos are extremely elusive particles with a very small mass and no electric charge, the existence of which had been postulated to permit the laws of conservation of energy and momentum to remain valid in such phenomena as emission of beta particles by radioactive atoms.

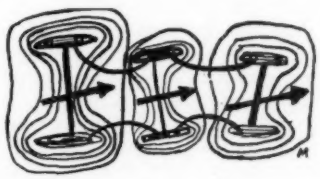
siderable scientific interest, dispelled these fears by showing that even a very intense beam of neutrinos will pass through the human body without scoring a dangerous number of "hits" on the atoms in it.

The other experiment which I wish to mention is the proof, first furnished by Snell in Oak Ridge, of the instability of the neutron and its decay into a proton and an electron. This was probably the first case in which spontaneous disintegration of what is usually called an "elementary particle," i.e., the fact that it disintegrates even if under no influence from other particles, was proved experimentally. This goes far toward proving the complex nature of the concept of "elementary particle." Unfortunately, neither Snell nor Robson have been successful so far in establishing accurately the average life of the neutron, even though Robson worked with the Canadian pile which has the highest neutron density. This enabled him, however, to measure the energy spectrum of the electrons released by disintegrating neutrons.

STIMULATION OF OTHER FIELDS

Let me begin my review here with a story, even though it is probably apocryphal. Dr. Compton, the leader of the plutonium project, discussed the problems and difficulties of his project with another leader, himself one of the country's most distinguished chemists. "Even if you get the chain reaction established, there still remains the big problem of the chemical separation of plutonium on an industrial scale," remarked the latter. "Seaborg thinks he will have a process worked out in two years," countered Compton. "He is good, but not that good," was the answer. He was, however; in fact, he beat the deadline. His and his colleagues' work lead to a revival of inorganic chemistry—a reversal of the conviction so prevalent with many before the war, that problems of inorganic chemistry were uninteresting because they were all already "solved in principle." They may have been solved in principle, but no one was able to apply those principles in all the important cases, and the exploration of many a neglected corner of inorganic chemistry proved richly rewarding for the explorer. Thus, inorganic chemistry again became an experimental discipline, much of it in the old spirit, though not unmindful of the great accomplishments of the thermodynamic studies of the last half-century. The work of those of Seaborg's colleagues whose ideas have not been used in the process actually employed for plutonium separation contributed equally to the rebirth of some branches of chemistry. One of these processes, in particular, led to the development of a successful method for the separation of the rare earth metals from each other, an objective which was never before fully attained, and to the separation of nucleic acids which heralds new progress in biology. This process is the ion exchange process, so successfully employed by Boyd, Cohn, Spedding,[8] and others.

Leaving aside the work on the effects of radiation on chemicals and on living organisms—fields in which progress was to be expected—we turn to a subject somewhat less obviously connected with atomic energy, but which has also greatly benefited from it. Problems of metallurgy and questions concerning solids arose because most ordinary structural materials absorb too many neutrons to be used in a reactor.



The requirement of low neutron absorption cross-section excludes all but a handful of elements from use in reactors. In addition, reactor materials must have high thermal conductivities and good ductility. Otherwise, they will rupture as a result of the intense heat flow produced in a reactor operating at a high energy level. Finally, the characteristics of reactor materials must be affected as little as possible by the intense radiation to which they are exposed. Metallurgy has to solve a very difficult problem indeed.

As a by-product, the investigation of the effect of radiation on solids has already yielded much interesting information about the solid state. The effect is twofold: the atoms which scatter the neutron elastically are thrown out of their regular positions in the lattice, leave a vacant position behind, and either get stuck in the lattice as "interstitial" atoms or wander off to the surface. The ratio of the two gives direct information on the facility with which atoms can move about in the crystal lattice. Even more important is the possibility of artificially creating a controlled number of vacancies and interstitial atoms in a crystal lattice and of studying their physical and chemical behavior as function of temperature. These studies opened up a new experimental technique which is as yet hardly exploited.

The second type of radiation-induced change in solids is caused by the nuclei which absorb a neutron or undergo some other nuclear reaction. As a result of these processes a new element replaces the old one in the lattice; an artificial "impurity" has been created. Such impurities are responsible for many interesting and important properties of solids. For example, the conductivity of germanium, the miracle element of transistors, is governed by the type of impurity present in it, and Lark-Horovitz and his collaborators, at Purdue and Oak Ridge, were able to change the type of electric conductivity shown by this material by irradiating it. This is one of two ways in which reactors helped transistor research; the other is due to the fact that without the radioactive tracer technique, the measurement of "natural" impurities responsible for the transistor action could hardly have been carried out with the required precision.

Before leaving this subject—the stimulation of various sciences by the problems and facilities created by reactors—I should apologize for not having more than mentioned the ways in which reactors have influenced the life sciences. Space limitations naturally imposed on an article of this type provide a welcome excuse to restrict myself to subjects of which I have some comprehension.

PHILOSOPHY OF THE SCIENTIST

We are still too close to the changes which the Uranium Project has evoked in our thinking to assess them in any but a most tentative fashion. The two most obvious general effects of the advent of atomic energy on the scientist's way of life are clear enough: he has more financial assistance in his scientific endeavors than he ever had before, perhaps more than is good for him, and he has to take himself more seriously than he had before, perhaps more seriously than is good for him. These changes are so obvious that they are hardly worth a comment. However, the scientist's experiences while working on the atomic energy program also had effects on his general evaluation of the role and essence of science which are more subtle.

The work on atomic energy gave

(*Continued on page 80*)

[8] See F. H. Spedding, "Chemical Aspects of the Atomic Energy Problem," *Bulletin*, V (February 1949), 48–50.

Book Review

ECONOMIC ASPECTS OF ATOMIC POWER

JOSEPH E. LOFTUS

In this article an economist analyzes the recent study on atomic power sponsored by the Cowles Commission. Mr. Loftus was formerly director of the research project on "Economic Implications of Atomic Power" at the Teaching Institute of Economics, the American University, Washington, D.C.

THE recently published Schurr-Marschak study[1] is significant for at least four major contributions which it has made to the literature on the economic significance of atomic power. First and foremost has been its clear demonstration that there are two unknowns, two barriers to an understanding of the economic implications of atomic energy: There are no experientially derived quantitative data on atomic power costs, and there are almost no analytical techniques or principles in traditional economic thought with which to predict the economic consequences of such costs, were they known. This latter handicap has, unhappily, not been generally recognized.

The second contribution of the treatise is the method whereby it handles the first unknown, i.e., the eventual magnitude of atomic power costs. The third contribution is the effort made to develop an analytical framework in reference to which the economic effects of atomic power at various assumed costs can be charted. And the final contribution of the book, (which flows from the second and the third one), is the series of substantive conclusions on what atomic power will and, especially, what it will *not* do for the world economy.

Partly because of space limitations, but largely because of the overriding importance of the first three contributions, this review will not dwell at all on the last subject.[2] Instead, detailed attention will be paid to each of the first three.

THE ECONOMIC PROBLEM

Prior to the appearance of the Schurr-Marschak study, it had become a too generally accepted proposition in the burgeoning literature on the economic aspects of atomic power, that the main problem impeding a clear understanding of the economic future of the innovation was the ignorance of atomic power costs. The bulk of the literature since Hiroshima has been characterized by tortured efforts to develop a quantitative estimate of the ultimate magnitude of these costs. Only a small fragment of it has been concerned with trying to trace the economic effects of a given cost estimate (however high or low it might be) on a highly interdependent, complex, and variable world economy. Indeed, the implication in many cases seems to have been that this part of the problem was simple. This is especially true in those instances where it has been urged that consideration of the economics of atomic power be postponed until after such time as a few power plants are in operation and providing quantitative data on costs. The implication of such suggestions is that it will be a relatively simple task to delineate the economic consequences of a change in energy costs once the latter are known.

In marked contrast to this generally accepted approach, the Cowles researchers have insisted that there are two great unknowns to be reckoned with: The question of costs is chronologically first, but much more important, and causing much more difficulty, is the fact that even if we knew what atomic power will eventually cost, economic "science" does not possess a tested and proved technique for forecasting, from these costs, what the economic effects will be on an intricately interdependent world economy.

The Cowles researchers clearly consider the first of these two unknowns rather unimportant for present purposes, and, in any event, not an insurmountable difficulty. The second problem, however, they consider so formidable that, in their opinion, only an enormous effort by many economists could produce an analytical framework and a valid and useful methodology for its solution by the time engineers have built a low-cost atomic power plant. Forecasting the economic effects of an invention is, for the economist, a lost language of which we possess only a few half-forgotten fragments. Typically, the economist has occupied himself in the past with problems in which he assumed either that there is no change in technology at all, or that this change is so slow and imperceptible that it can be disregarded. Against this historical background, it is not surprising that Schurr and Marschak modestly state in their Preface that their study has involved "a new attempt to formulate an economic theory of the effects of an invention."

The importance of the authors' preoccupation with the problems of economic theory and methodology cannot be overstressed. Careful examination of the little that has been written by economists since 1945 on atomic power shows that their conflicting conclusions as to the probable consequences which atomic power will have

[1] S. H. Schurr, and J. Marschak, *Economic Aspects of Atomic Power* (Princeton: Princeton University Press, 1950).

[2] See Schurr, "Atomic Power in Selected Industries," *Bulletin*, V (November 1949), 301–08.

for a given industry, or a given national economy, are due not so much to radically different assumptions as to its costs, but rather to radically different methods of interpreting the significance of these costs in a given economic situation.

Contrast, for example, the conclusions of Harrod[3] or A. J. Brown[4] with those of Schurr and Marschak. Even more strikingly, contrast the widely divergent conclusions of Schurr[5] and Isard[6] as to the economic implications of atomic power for industries such as iron and steel, or aluminum, or for regions such as Argentina. To a limited extent, the conflict of opinion is due to differences in the assumed atomic power costs; but basically it is the result of the employment of radically different and often conflicting conceptions as to the proper methods of analyzing the economic consequences of a technological innovation.

When one considers, on the one hand, the enormous complexity of the problem of making a comprehensive forecast of the economic consequences of atomic power, and, on the other hand, the undeveloped character of the economists' analytical tools for making such a forecast, it is something of a relief for an economist that we don't yet know what atomic power will cost. For, if we did know, it would be only because an atomic power plant were in existence and about to produce the economic effects which we are not equipped to predict.

As one observer has somewhat eloquently stated: "Merely to enumerate . . . [the factors to be taken into account and weighted against each other] gives an impression of the formidable nature of the assignment. . . . It calls for a brilliance of prognosis that has been occasionally demonstrated by the most gifted philosophers, and perhaps by a few of the Royal Commissions in the United Kingdom, but has hardly been characteristic of the routine reporting of administrative agencies. Perhaps the simplest method of demonstrating the difficulty . . . is to imagine what predictions would have been included in a report in 1900 on the social, political, and economic effects of the utilization of the internal combustion engine in the motorcar. What would the most learned of our economists have had to say about the number of cars that would ultimately be built—the quantities of basic materials consumed and investment and employment in manufacturing industry, dealers' establishments, and garages—about the expansion in the petroleum and tire industries and their distributing outlets; about the amount of highway and bridge construction and the consumption of basic materials involved; about the total effect of those primary and secondary factors on providing employment and maintaining an expanding economy? What would have been the [predicted] effects of the motorcar industry on railroads and railroad investment; on the distribution of population; on the structure of cities?"[7]

A partial indication of what might have been the answer to the hypothetical question raised by Mr. Newman is contained in another lengthy paragraph from a report on the attitudes toward the automobile which prevailed at the turn of the century. "Financiers were in no wise ahead of popular sentiment in reference to the automobile. They had no conception of its future development. . . . Both R. E. Olds and Charles E. Duryea testify as to the hostile reception they received in Wall Street, where the bankers could not see the wisdom of investing a few thousand dollars in what they considered a plaything. Chauncey M. Depew confessed that he warned his nephew not to invest $5,000 in Ford stocks because 'nothing has come along to beat the horse.' W. C. Durant's prediction that someday 500,000 automobiles would be manufactured annually in the United States is said to have provoked George W. Perkins to declare, 'If he has any sense, he'll keep those notions to himself if he ever tries to borrow money.' J. P. Morgan & Co. refused to buy for $5,000,000 in 1908 a block of securities which were later incorporated in General Motors and rose to a value of $200,000,000. The financiers exaggerated the numerous mechanical imperfections that existed in the early cars, stressed the absence of good roads, were deterred by litigations over the early patents, and above all could not envisage a profitable market."[8]

Then, in the case of the automobile, just as now in the case of atomic power, the predictive problem was only partially a question of knowing the relative costs of the innovation. The main question, then and now, was how to evaluate the consequences of these costs in a highly complex and interdependent economy.

This is the fundamental task which the prospect of atomic power poses for economic research in the immediate future. It is to be hoped that the timidity and complacency which has been evinced by economists to date will soon be replaced by an energetic effort in the universities, private research foundations, and various government bureaus to undertake this difficult problem. This hope springs not just from the prospects of atomic power, but also from the expectation of many other technological changes of major significance. If it is true that we are living in an age of great and rapid technological changes (of which atomic power is but one), then it is essential that there be soon developed tools for the prediction of probable economic and political consequences of such changes.

THE TREATMENT OF COST

Given the preoccupation of the Cowles researchers with the analytical techniques for quantitative economic analysis, it is not surprising that the question of atomic power costs is resolved, for their purposes, in ten short pages early in the book. Briefly, their position is as follows: First of all, no single cost value can be postulated because no operating power plant exists. Secondly, even if a few atomic power plants were in existence, one still couldn't postulate a single cost value because the first plants would probably be radically improved and the costs reduced with time. Thus, it might be many years after the first few atomic power plants came into being before one would possess a cost figure

[3] R. F. Harrod, "The Economic Consequences of Atomic Energy," *The Atomic Age* (London: George Allen & Unwin, Ltd., 1949).

[4] A. J. Brown, "Applied Economics," Chapter vii, *The Economics of Atomic Energy* (London: George Allen & Unwin, Ltd., 1947).

[5] S. H. Schurr, "Economic Aspects of Atomic Energy as a Source of Power," *American Economic Review* (Proceedings), May 1947; "Atomic Power in Selected Industries," *Harvard Business Review*, July 1949.

[6] W. Isard, "Some Economic Implications of Atomic Energy," *Quarterly Journal of Economics*, February 1948; W. Isard, and V. Whitney, "Atomic Power and Economic Development," *Bulletin of the Atomic Scientists*, March 1949; W. Isard, and V. Whitney, "Atomic Power and the Location of Industry," *Harvard Business Review*, March 1950.

[7] J. R. Newman and B. S. Miller, *The Control of Atomic Energy* (New York: Whittlesey House, 1948), pp. 138–40.

[8] National Resources Committee (Subcommittee on Technology), *Technological Trends and National Policy* (Washington: U.S. Government Printing Office, 1937), p. 44.

that could be considered a useful constant. If it is true that the main problem for the next few years is to develop methods for forecasting the economic effects of a change in power costs, it would be a waste to spend much time on trying to derive a single cost figure, that only by sheer luck might turn out to be equal to what atomic power will ultimately cost.

Rather, the authors contend, the thing to do is to select several cost figures, from the lowest conceivable figure that atomic power costs could attain, through a reasonable medium figure, to a reasonably realistic maximum. With these figures as a starting point, experiments in methodology can be conducted. If the methodology is well developed, then at a later date, when atomic power costs become known experientially, these data can be fitted into the previously analyzed range.

The selection of the lowest cost figure rests on obvious technological facts. According to what is now definitely known about atomic power plant technology – occasional wild newspaper rumors to the contrary notwithstanding–electric power will not be derived directly from the pile. On the contrary, certain costly items of equipment (e.g., heat exchangers, turbines, etc.) that characterize present-day conventional power facilities, will also be integral parts of an atomic power plant. The cost of these items, which is known, and the lowest conceivable estimate for the unique atomic facilities (e.g., the pile) determine the lowest level to which atomic power costs may conceivably fall. It may well be that these costs will never become that low; they certainly will not fall below this limit, no matter what technological improvements may occur.

By thus establishing this lower limit at four mills per kwh., plus or minus one mill, depending on the load factor, the authors avoid wasting effort on evaluating economic effects of power costs below this minimum.

In view of some recent public statements that the first experimental atomic power reactors will cost in the neighborhood of $14,000 per kilowatt of electric power capacity,[9] it is quite possible that other reviewers of this book will question the realism not only of the Schurr-Marschak minimum cost assumption, but even of their maximum cost assumption, which is ten mills per kwh. or $315 per kilowatt of electric power capacity. Were it not for the fact that there are several obvious flaws in the $14,000 estimate, there would be some sound basis to this contention.

This figure originally appeared as a typographical error in the mimeographed press release issued prior to Dr. Hafstad's speech at Detroit on May 23, 1950.[10] Despite the fact that it was quite apparent from the arithmetic of the text that it could only have been $1,400, despite the fact that Dr. Hafstad corrected the error during the presentation of the speech, despite the further fact that a mimeographed "errata" press release was issued on June 2, 1950, and despite the final fact that, in a subsequent speech at Los Angeles on November 15, 1950,[11] Dr. Hafstad unmistakably asserted that the figure was $1,400 and not $14,000, this figure has continued to capture the pessimistic imaginations of some writers.

Of even more significance for the economic practicability of atomic power than this reduction from $14,000 to $1,400 are the statements by Dr. Hafstad that this is an "upper limit on cost," and that the figure contains "high cost items where savings seem possible." These items he subsequently details as: (*a*) "high development costs of a prototype reactor," (*b*) "high costs for meeting naval requirements of weight and space," (*c*) "high costs of reprocessing fuels," (*d*) "high costs introduced by extreme security precautions," and (*e*) "high costs introduced by extreme personnel safety precautions." That Dr. Hafstad rightly emphasizes points (*a*) and (*d*) is well illustrated by the known fact that the contract for the first two experimental models of the B-36 airplane was signed at a unit cost of $19,737,617 per plane, while the second contract for ninety-five improved planes was signed at a flyaway unit cost of $4,183,691.[12] Points (*b*) and (*c*) introduce large cost elements that would not be involved in stationary, land-based reactors.

Though not stressed as much by Dr. Hafstad, there is the important point that the Ship Propulsion Reactor is a single-purpose reactor which is designed to be a consumer of enriched nuclear fuels. By contrast, the reactor envisaged by Dr. Thomas, to operate at about the same cost level as the Schurr-Marschak maximum figure, is to produce enough plutonium for its own requirements. The Schurr-Marschak maximum figure is an average for a system of plants; some of which would be pure consumers of nuclear fuels, while others would be breeders of plutonium.

To summarize, thus far, the maximum cost figure postulated by Schurr and Marschak is quite consistent with the estimate made by Dr. Thomas; and Hafstad's figure of $1,400 per kw. hour of electric capacity does not put the Thomas or the Schurr-Marschak maximum estimates into serious doubt. Since the Thomas and the Hafstad estimates are the only ones that are, in any sense, "authoritative," it must be concluded that the Schurr-Marschak maximum cost estimate for commercial atomic power plants in the first stage of technical development is not at all unrealistic.

No special explanation of the selection of the Schurr-Marschak intermediate cost figure seems required. Its justification rests on two grounds: (1) It is half-way between the two extreme estimates; and (2) it is very close to the competitive threshold point of conventional energy costs in many regions of the U.S. and the world. Given the methodological orientation of the Cowles study, no other justification is required.

These, then, are the assumptions as to atomic power costs used in the study. Essentially, it is a range of costs developed as realistically as existing knowledge allows, to provide a jumping-off place for an intensive effort to develop and test analytical techniques for examining the economic consequences of atomic power. With this orientation, it is a sound, and, indeed, ingenious way of approaching the problem.

One final word on cost estimates. It has been objected by one reviewer that the use of this range of costs introduces "unnecessary confusion and assumptions" into the study, and that "the analysis could have been simplified and the reading made less cumbersome had they answered directly really relevant questions," such as to

[9] C. Holcomb, "The Best-Kept Atomic Secret," *The Reporter* (December 12, 1950), pp. 17–20.

[10] L. R. Hafstad, "Problems in the Application of Atomic Energy," Remarks before the Society of Automotive Engineers, Detroit, Michigan, May 23, 1950. USAEC mimeo press release.

[11] L. R. Hafstad, "Reactor Program of the Atomic Energy Commission," Remarks before the American Petroleum Institute, Los Angeles, California, November 15, 1950. USAEC mimeo press release.

[12] Lt. Gen. E. W. Rawlings, Testimony at Hearings before the Committee on Armed Services, H. R. on H. Res 234. 81st Congress, 1st Session (1949), pp. 444–55.

what levels would costs have to fall in order to make atomic power competitive, or in order to begin to produce certain economic effects?[13] To this criticism, one can only reply that, while it is of no little consequence to know the levels to which atomic power costs must fall in order to produce economic effects on an industry or a region, it is of much more consequence—and involves much more intricate analysis—to apprehend what the effects will be once the competitive threshold is reached, and then passed.

THE ANALYTICAL TREATMENT

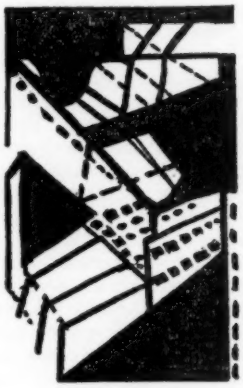
The major contributions of the Schurr-Marschak study to the central question of how one goes about tracing the economic effects of a change in power costs must be discussed under two headings: the industry case-study method, and the total economy approach. The two approaches are radically different in all respects, including the degree of success achieved.

THE INDUSTRY CASE-STUDY METHOD

Essentially the industry case-study method consists in taking a particular industry where power is a major factor in costs and examining it in detail to determine the effect on it of a change in power costs—most other economic variables being held constant. In going about these case studies, the Cowles researchers concluded that for each industry it was necessary to answer three basic questions. First, will industries in which energy costs loom large, experience significant cost reductions as a consequence of atomic power at the three assumed cost levels? Second, will atomic power, because of its relatively low cost, induce or accelerate the introduction of new production techniques? And, finally, will atomic power, because of its comparative equality throughout the world, produce a movement to new sites, having marketing, supply, or transport advantages not held by areas near low-cost conventional fuel and power?

Implied, but not as sharply expressed as these three, is still a fourth important question: Will atomic power, by inducing process change, cause changes in the organization of certain industries, increasing or lessening the minimum economic size of the major producing units in the industry? This subtle but important question obtains its clearest expression in the iron and steel industry, where a process change might very well bring about, in time, a lessening of the economic necessity for large business units at the early stages of the production process.

The principal original contribution of the individual industry studies by the Cowles Commission is the introduction of the concept of induced process change. All writers on atomic power have considered the obvious question of cost reduction; most have considered also the implications for locational change; but none have treated the question of process change. Yet, considering the probable time span before commercial atomic power will become generally available, and considering the intricate interrelationships between invention in power production and power consumption, it is a most important question.



Not only has the formulation of the three central questions been a most significant contribution, but equally important has been the technique developed for incorporating the three concepts into an orderly quantitative analysis of a given industry. These several case studies (aluminum, chlorine and caustic soda, phosphate fertilizer, cement, brick, flat glass, iron and steel, railroad transportation and residential heating)[14] are superlatively well done, and should serve as an excellent guide to future students of the subject wishing to extend the Cowles analysis to other power-consuming industries.

In this connection it is to be hoped that other students will take up the individual industry studies and advance them in two directions. There are more than a few industries (e.g., water transportation, air transportation, agriculture, non-ferrous metals) in which similar detailed studies are urgently required. For example, in view of the probable early development of reactors for ship propulsion, a detailed study of this field is clearly required if for no other reason than to spell out the empirical research problem. It is obviously going to require a quite sophisticated analytical framework to account for such things as: the significance and economic value of savings in fuel costs at varying speeds, the economic value of increases in speed for ocean cargoes, the significance of small savings through shortening of the "turn around" time, through space conservation, through induced selection of new or unconventional routings, the significance of possible radical changes in ship design and operation induced by atomic power, the impact of losses through possible obsolescence of existing port facilities—either because of radiation hazards, or because of induced changes in the size and shape of cargo ships, and so on.

To take into account simultaneously all these factors in a case study of water transportation is clearly a tortuous task. Although the methods developed in the quantitative analysis of railroad transportation will be useful and suggestive; nevertheless, much original and careful thinking will have to be done. The same is true of air transportation and agriculture—especially the latter; for the potentialities for induced process change (for example, substantially greater electrification) are almost limitless.

It is likewise hoped that future researchers will re-examine the case studies of the Cowles Commission against the background of regions of the world other than the U.S. Although it is true that in each of the chapters broad reference is made to the possible implications of atomic power for various regions of the world having actually or potentially the same industries as were studied in the U.S., nowhere are these references explored in the quantitative detail that is really required.

THE TOTAL ECONOMY APPROACH

Although a quantitative analysis of separate industries is most useful in giving a broad picture of a wide range of implications of low-cost atomic power, nevertheless, this technique

[13] W. Isard, "The Uses and Costs of Atomic Power," *The Nation* (December 16, 1950), pp. 657–59.

[14] A summary of these studies was published in the November 1949 issue of the *Bulletin*.

has obvious limitations when an overall appraisal of the effects of atomic power on any given national economy as a whole is desired. In recognition of this fact, Part III of the Cowles study attempts to develop analytical techniques which will provide this kind of appraisal.

In general, the techniques developed leave the reviewer unimpressed. The national-income type of analysis, employed with reference to advanced economies like the United States and Great Britain, has been tried before and found wanting. The ingenious refinements supplied by the Cowles researchers fail to remedy substantially the inherent limitations of this technique for assessing with any accuracy the probable over-all economic effect of low-cost atomic power.

For the United States, for example, this technique cannot accurately reflect such important results as: (*a*) radical upward changes in the level of demand for power as the result of induced process changes, (*b*) the impact on a national economy of industrial relocation within its component regions. (For example: what would be the economic effect of low-cost atomic power in inducing basic industries such as iron and steel to move to New England? What would be the economic effects of this on New England as a whole, and, in turn, on other regions of the U.S. that are now benefiting economically from the exodus of industry from this region? What would be the effects on the coal and transportation industries that would thus lose coal markets in New England?) It cannot answer such questions as: (*a*) What will be the impact of entirely new industries which atomic power may well engender? (*b*) What will be the economic effects on the U.S. if it becomes a large-scale producer and exporter of atomic power plants to other regions of the world? (*c*) What will be the reflected economic effects of the U.S.-assisted industrialization of undeveloped economies of the world (via, among other methods, atomic power) on the external trade patterns of the U.S.?

All these, and many other crucial questions elude—as they always will—the scope of the national-income approach. At best, it may be said that the Cowles effort in this direction should demonstrate conclusively that this type of approach is hopelessly inadequate.

The effort to develop techniques for assessing the probable economic implications of atomic power for backward areas of the world is even more limited in success. With due respect to the Cowles researchers, it must be remembered that here they faced a truly formidable problem. For, in this regard, not only were they required to make a new attempt at formulating an economic theory of the effects of invention, but they were forced to attempt the even more difficult formulation of a theory of economic development of backward areas. In combination, these two tasks are a most formidable assignment. At a minimum, the work of the Cowles group demonstrates the urgent need for a vigorous intellectual effort in this direction if we are ever to have any understanding of the implications of technological change for underdeveloped economies.

Although the treatment of backward economies in general is inadequate, at least three very significant concepts have been developed. It is hoped other scholars will exploit these concepts in empirical analyses of individual regions like Argentina, Brazil, Italy, Southeast Asia, India, Northwest Africa, South Africa, etc.

In the first place, there is the concept of "capital savings." Essentially what is involved here is the possibility that atomic power may effect substantial savings for countries striving to industrialize themselves by rendering unnecessary some of the capital investment that otherwise would be required in coal mines, coal-carrying railroads, and hydroelectric projects poorly located with respect to raw materials and markets. Since one of the major impediments to industrialization is the enormous amounts of capital required, any technological change that will reduce it will be a great boon.

In the second place, there is the concept of foreign exchange savings. For countries deficient in conventional energy resources (e.g., Brazil and Argentina), large amounts of scarce foreign exchange have to be set aside annually for payments of imports of petroleum and high-grade coal from distant sources. If, as seems quite likely, the annual foreign exchange outlay in payment for interest and amortization of the cost of atomic power plants will be substantially less per kwh. of power generated than the comparable foreign exchange outlay for importing conventional fuels, such countries will be provided a flexibility in their foreign exchange position and development planning that will be of significant value.

Finally, the essential mobility of atomic power makes possible the construction of industrial complexes about a cheap power source which can be located at a point where total transport costs for a given combination of industries will be minimized. Here again, atomic power has a unique attractiveness for underdeveloped economies.

It is to be hoped that other researchers will build on these concepts and make empirical studies of individual national economics throughout the world. Just as the Cowles Commission deliberately avoided examining the possible effects of atomic power on the abstract, schematic concept of "industry," so also future research must avoid approaching the regional development problems in terms of abstractly conceived "backward economies." A valid conception of the probable economic effects of atomic power will be found only in the hard political and economic realities of a particular backward region.

Accordingly, it is to be hoped that at the earliest possible time, detailed empirical studies of the possible implications of atomic power will be made for such economies as Brazil, Argentina, Italy, India, the USSR, Southeast Asia, Japan, South Africa, Northwest Africa. Each one of these presents an entirely different problem with respect to resource endowment, present state of industrialization, conventional energy availability, quantity and quality of population, government structure, national ambitions, and international trade position.

In summary, the book as a whole is very much of a milestone, a turning point in the five-year-old history of thought on the economic consequences of atomic power. It is a bold, fertile, pioneering effort. At the very least, it has served to show that this is anything but a simple problem that can be handled with easy, uncritical generalizations. At best, it has provided a much needed analytical springboard from which other researchers can make new advances.

Finally, one can hope that the mere existence of the book will provoke other professional economists who, curiously enough, have, to date, had the least to say on the economic effects of atomic power, to attack this important area of economic inquiry. This is needed not merely for the evaluation of the potentialities of atomic power, but for the solution of a whole range of problems which an accelerating rate and volume of technological changes produce.

ATOMIC SUPERIORITY—A WASTING ASSET

CLIFTON M. UTLEY

Senator Taft's speech in the Senate on January 5 has called forth many rejoinders. In this article a well-known news commentator of the National Broadcasting Company questions Mr. Taft's assumption that American superiority in atomic weapons can indefinitely deter the Russians from an attack on Western Europe.

ALTHOUGH he makes some exceptions, Senator Robert Taft's basic belief is that we should commit no American troops to Europe at this time. For our defense he thinks that we should rely principally on an enlarged navy and air force, plus an army of reasonable size, but not large enough to enable us to engage in ground warfare in Europe.

In one of the key passages of his address to the Senate on January 5, Mr. Taft says, "But I do not think we should force our assistance on nations which do not wish to arm themselves. I do not think we should insist or even urge that the European nations form a great international army unless they request us to help them in that project. I do not think we should assume the leadership in the formation of a great international army by the appointment of an American commander-in-chief." "The initiative," Senator Taft maintains, "should be theirs and not ours."

But unless we take the initiative, as we have done through the mission of General Eisenhower, no adequate Western European army will ever be created. This is not because Europe does not want such an army. It is because of the fact, which all history has shown to be true, that only a leader can lead. In today's world there are just two nations with the power to lead. They are Russia, and ourselves. Russia is on the other side of the fence. She is trying to collapse the free world, so that she can seize it. That leaves only ourselves to assume the leadership of the free world. Although Europe may provide three-fourths or more of the divisions for an Atlantic Pact-Western European defense army, those divisions will not be formed, and the effective Atlantic Pact defense force will never come into existence unless we take the lead.

IS A EUROPEAN GROUND DEFENSE FORCE NECESSARY?

But is an effective Atlantic Pact-Western European ground defense force necessary to America's security? Senator Taft seems to think that it isn't. He says, "I do not myself see any conclusive evidence that (the Russians) expect to start a war with the United States. And certainly I see no reason for a general panic on the assumption that they will do so."

So far as the present is concerned, I think most persons would agree with the Senator on this. Whether the same would be true once Russia had conquered all Europe and mobilized Europe's industrial resources in the service of further Russian imperial aggression is another matter. It seems obvious that if she got Europe, Russia would then have a go at Latin America, which is weak and would doubtless topple. Then, after she got Latin America, it would be war against us on our home grounds.

If that is correct, it is a vital American interest to keep Russia from getting Europe.

Perhaps it will be argued that for the present there is not too much likelihood that the Russians will make a military attack on free Europe—that Russia is more likely to try to get Europe by infiltration and subversion. I agree—for the moment.

But I also submit that there is a very close connection between military defense and decisive American leadership on the one hand, and Europe's ability to resist infiltration and seizure via the subversion route on the other.

If Europe feels there is no hope for an eventual effective military defense against a Russian ground attack, if she feels we are disinterested in such defense and offering no leadership to bring it about, then Moscow is certain to get Europe via the subversion and infiltration route. Because then Russian agents will be able to preach to all Europeans the doctrine that they might as well give up, because Russia is able to overrun them militarily if they don't. Europe will know that Russia has this power. Peoples seldom resist when there is no chance of resistance being effective. By that route, all Europe is certain to be given the Russians on a platter.

ATOMIC BOMB—A WANING ASSET AS DETERRENT TO WAR

But, won't the atomic bomb keep the Russians from attacking? It might do so for a while, but even if it did, it seems certain that the absence of any developing ground defense would convince Europe that it would be hopeless to try to resist. For the Europeans know that the deterring influence on Russia of our atomic weapons is bound to grow less as time goes on.

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Either Russia will catch up to us in the production of atomic weapons, or, if she doesn't, if we maintain our present lead by speeding our atomic progress at the rate she speeds hers, our margin of superiority will be constantly less effective as a deterrent capable of keeping Russia from making war.

An American atomic lead of 10 to 1 over Russia is a significant deterrent to Russia, only if the total number of bombs is small.

If we have enough atomic weapons, plus the means of delivering them, to wipe out all of Russia's essential industry, and Russia has sufficient atomic weapons, plus the means of delivering them, to wipe out only one-tenth of our essential industry, we have a great advantage. But, if both sides continue atomic production for a number of years, a stage will eventually be reached—even assuming we keep the 10 to 1 lead—when Russia will have *enough* atomic weapons, plus the means of delivering them, to wipe out all our essential industry, and we will have enough weapons to wipe out their industry ten times over. The lead remains, but a situation of parity has been achieved, since if our industry is wiped out, and theirs is too, it makes little difference that we have hidden stockpiles of bombs sufficient to wipe out Russian industry nine times over—if it still existed.

Once the Russians think they have sufficient atomic weapons to wipe out even a considerable percentage of our industry, they may feel they are safe in attacking Europe militarily, in the conviction that, whatever we say, we will not go to war if we know the price is the destruction of millions of American people and much of our industry and if, not having contributed to the creation of any effective European ground defense, we know Russia can overrun Europe in short order.

That is one reason why it is essential to develop an effective European ground defense before the moment when our atomic superiority has lost the deterrent influence it now seems to exercise on Russia.

Another factor which may decrease the deterrent effect of our atomic arsenal, as time goes on, has been stressed by Dr. Vannevar Bush: it is the growth of Russian air defenses which may lessen our capacity to deliver bombs to their targets.

Senator Taft, in his address, said, "There is no need for a specific line of defense, but we can exercise a power for peace over a vast area. If the Russians realize that power cannot be challenged, and we can do real damage to their nation with the atomic bomb and otherwise, their purpose of military aggression may well wither, and gradually peaceful relations in Europe may grow again."

Here Mr. Taft admits Russia's purpose of military aggression; he simply hopes our power at a distance, mainly the bomb, will cause it to wither. The exact opposite would be much more likely to take place over any considerable period of time. The deterrent effect of our atomic superiority is bound to decrease, not increase. In the default of other deterrents, Russia's will to military aggression is bound to increase as the bomb's deterrent effect fades.

THE CASE AGAINST TAFT'S ARGUMENT

I would like to sum up this case against Senator Taft's basic argument in a few simple points:

1. The keeping of Western Europe's industrial resources available to us and out of Russian hands is a vital American interest, because unless they are kept out of Russian possession, Russia will gain the industrial and political power to make war on us on the home grounds—right here in America.

2. The deterrent power of our atomic bomb, although considerable right now, is a wasting asset. It will not permanently keep Russia from taking Europe.

3. It follows that an adequate European ground defense is necessary if Europe is to be kept from falling into Russian hands.

4. Without American leadership this European ground defense cannot and will not be created, because only nations with the power to lead can give leadership. In today's world, only we and Russia have the power to lead.

5. It follows then, that the creation of an effective European ground defense is a vital American interest, and that it is worth some sacrifice by this country to help bring it into being.

Those are the basic points, but there is one more argument, frequently used by Senator Taft, that still needs to be dealt with. It is that if we rush ahead with the rearming of Germany, the very fact of so doing may cause Russia to rush into a land attack on Europe, before Europe's defenses are ready.

This risk does exist, and because of it, I suggest that there may be valid reason for going slowly with German rearmament at this time until our airpower, which would have to deliver the atomic bomb, can be built up to maximum effectiveness, and thus give the bomb its maximum deterrent power, and until we can make more progress in the development of our own land forces. But this is an argument for developing our ground forces, not for limiting them, as Senator Taft urges.

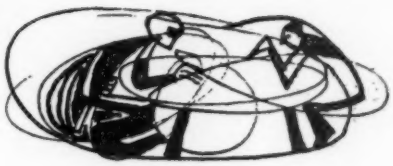
Even if we allow the time schedule I have just suggested, there will still remain the element of risk on which Senator Taft correctly insists. My feeling is that this risk will have to be taken, since, for the reasons I have developed, the resources of Western Europe are a vital American interest, and, unless an effective European ground force is developed, Russia will eventually get all Europe anyway.

My argument, in brief, is that if a risk has to be taken, it is better to take it while the deterrent effect of our atomic bomb is at its maximum, and when the bomb still might keep the Russians from marching through Europe, rather than to wait until later when the bomb's influence will definitely be less, and when it would have the minimum chances of keeping the Russians from marching.

COMFORT TO THE ENEMY

As this issue goes to press, we hear that a number of graduate science students, particularly physics students from China, are being deported back to China by the Immigration Office. We hear that the reason for this is their membership in organizations whose top leadership in America has allegedly been infiltrated by elements in sympathy with the Communist regime. It is not asserted that either the local groups to which they belong, nor the students themselves are Communist followers, and some of the deportees assert that their anti-Communist associations will probably cause their arrest and persecution upon their return to China. In any case, by this action, the U.S. Office of Immigration presents the Chinese government with a valuable addition of exceptionally gifted and well-trained people to its meager scientific manpower and deprives the American scientific manpower of a small but potentially quite useful addition.

THE BOLSHEVIK ELITE: AN ANALYSIS OF A LEGEND



EDWARD SHILS

Professor Shils, a member of the Committee on Social Thought, University of Chicago, believes that the political discussion of the present century has been dominated by certain legends. One of the most influential of these has been that concerning the nature of Soviet society. In the following essay he presents some reflections on the background of this legend and contrasts it with what he considers a more realistic view, formulated in Mr. Nathan Leites' "The Code of the Politburo." Mr. Shils has recently completed an investigation into Soviet leadership.

FOR at least a quarter of a century, sympathetic Western observers have tended to see in Soviet communism a variant of democratic socialism which had temporarily gone off the main track of social progress in order to return further up the line at some future date. The critics of Bolshevism, with the exception of a few writers like Bertrand Russell and Waldemar Gurian, have been so much out of sympathy with the Bolshevik pretensions to stand for social justice that they have spent their credit in furious denunciations of limited appeal. The obvious partisanship of many of the Social Democratic detractors and the narrow class-bias of the anti-Socialists made the realistic assessment of Bolshevism nearly impossible.

The Great Depression of the 1930's, the Spanish Civil War, and the establishment of National Socialism made the understanding of Bolshevism even more difficult for most educated Westerners. At a time when their own ruling groups were failing to deal adequately with economic problems, the intellectuals, already disposed to take a critical attitude toward their own authorities, fell an easy prey to the propaganda of the Communists regarding the efficiency and justice of the rulers of the Soviet society—"the land without unemployment." Since they took little interest or part in politics before the Depression, were contemptuous on the whole toward their own politicians and impatient with the cumbersome roundabout methods of representative democracy, Western intellectuals did not readily see any grounds for complaint against the methods of the Soviet political leaders, who seemed to them to be more benevolent, although perhaps less democratic, than those in their own countries. Newly aroused to an urgent sense of the injustice of their own system, and more concerned with results than with methods, the apparent deviation of the Bolshevik elite from the "purely formal liberties" of "bourgeois" democracy did not strike Western intellectuals as very significant even where they were willing to concede that they were real. Remote from conventional political experience and repelled by it, their inexperience and their anti-authoritarianism made it easy for them to accept the communist conception of politics as a conspiracy behind a facade—an immoral conspiracy of Wall Street or the City against the moral and necessary conspiracy of the Communist Party. Their naïveté about human motives and especially their ignorance of the motives of political life allowed them to fall for the economism of the Communists. The importance of "theory" in communist policy and action, the special praise for scientists and intellectuals which communist propaganda stressed, made a picture of communism extremely appealing to intellectuals. The claims of Communists to represent social justice and the constant stress that the Soviet Union as a whole and Communists in each country were the victims of capitalist cruelty preyed upon tender consciences and prevented realistic criticism. The whole background of many middle-class intellectuals in the West made them into almost "natural" Stalinists, even where they did not join the Party, as relatively few of them did. This disposition facilitated the perpetration of one of the greatest hoaxes in modern history. Nearly every complaint which they had with their own society fostered corresponding illusions about Soviet society.

Seeing their own societies as demoralized and insufficiently integrated, they saw Soviet society as dominated by an almost unanimously shared purpose. While in the West, science was being used to destroy man or was being inhibited by political interference, in Soviet Russia it was lovingly developed for the service of man. Whereas in Western countries, citizens possessed only empty political rights which they could not use for any substantial end, in the Soviet Union, they had economic freedom. The existence of racial discrimination in the West implied that there was racial equality in the Soviet Union.

The hoax was intricately ramified and far-reaching. We should like here to pay particular attention to the legends of the Soviet ruling class which were in some measure manufactured by communist propagandists and in part produced from the counter-patriotism of intellectuals—by the need to respect some powerful authority coupled with the inability to respect one's own political and economic elite. Guilt feelings concerning Allied intervention during the Russian Civil War and the belief that they or their rulers had been unjust fostered a concurrent belief that the rulers of the Soviet Union were making a worthy and generous effort to raise the condition of mankind to higher levels of well-being and dignity. The image of a hard-headed lot of men, their minds focused on a high and remote ideal, driving ahead with all of the resources of natural and social science to transfigure and elevate the life of man on earth was the communist propaganda picture of the Soviet elite. In the course of the 1930's, it came to possess the thought, not only of Party

members but of persons of apparently independent judgment who admired purposefulness and efficiency and who were impatient with respect for convention and tradition. For those who were repelled by the rhetorical cant of their own politicians at home and the secretiveness of the established diplomatic procedures, the Bolshevik elite with its tough outspokenness and its hostility toward secret diplomacy seemed to represent an ideal. Ever since Lenin's direct appeals to the workers in foreign capitalist countries and Litvinov's proposals for drastic disarmaments in the League of Nations, Bolshevik procedures in international relations have enjoyed a high esteem from those Western intellectuals who were repelled by the "undemocratic" secrecy and the unimaginatively rule-bound methods of traditional diplomacy. Soviet intervention in the Spanish Civil War when the United States declared an embargo on the export of armaments, and France and Great Britain adhered to a policy of nonintervention, was widely accepted as evidence of the wholesome purposes of Soviet foreign policy and of the freedom of the Soviet elite from hypocrisy and narrow self-interest. The communist denunciation of fascism, which far exceeded in vigor that which came from official circles of the Western democracies, strengthened the tendency to idealize the Soviet elite.

The shocking experience of the Moscow trials and the great purges alienated some supporters. The vast majority of those who had fallen victim to the great hoax and of their own "natural" predisposition to Stalinism remained true, however, to their new faith and found indeed many ingenious or naively simple arguments to justify it. Only the Soviet-German pact shook the fellow-travelers and the broader mass of non-Communists of *Stalinoid* outlook. After June 1941, the *Stalinoid* mentality more than recouped its losses. A mixture of gratitude for Soviet resistance and bad conscience for having judged an ally negatively combined with a fierce communist propaganda offensive to re-establish the image of the benevolent, realistic, and efficient ruling group desirous of living at peace with the world and ambitious only to develop its own resources and to improve the life of its own people. The myth of the Soviet elite was even more strongly espoused than it had been before the war, and it spread to sections of the population which previously had been indifferent or hostile to the Soviet regime. By the time the war ended, only a few persons with long experience and realistic judgment and the die-hard anti-Communists refused to share in this common phantasy. The former either discretely restrained themselves or were held in check by frowns from high places. The fury and vehemence of the latter, the anti-Communists, made it difficult for the victims of the hoax to clear their heads. The mere fact that anti-communism used, as in the case of the Committee on Un-American Activities, such disreputable methods and was so indiscriminate and violent in its accusations hid the grain of truth in the vituperation and rendered suspect its acceptance. Moreover, the high desirability of good relations between the Soviet Union and the West encouraged the hypothetical acceptance of the legend, even though it was not genuinely accepted.

Meanwhile, the world has moved, and many have been disillusioned. Our knowledge of the day-to-day details of life in the Soviet Union has been greatly increased, and the aggressiveness of the Soviet Union and its obstructiveness in the United Nations have contributed greatly to our sophistication. An extraordinarily valuable aid to our understanding of the principles underlying the action of the Soviet elite is now provided for us in Nathan Leites' *The Code of the Politburo*,[1] a brief book which is an advance report on a fuller and more thoroughly documented treatise which is to appear later. Our image of the Soviet elite is greatly ordered and clarified by this brilliant essay which has the double merit of strengthening our practical judgment on a matter of the most pressing importance and making an impressive forward step in the long uncultivated analysis of the behavior of political elites.

Mr. Leites has concentrated remarkable analytical powers on a single task —namely, the reduction to a clear-cut body of principles of the explicit and implicit rules which the two greatest Soviet leaders have followed in their guidance of Bolshevik affairs over the past half-century. The books, speeches, articles, memoranda, etc., of Lenin and Stalin have been meticulously scrutinized in the context of the concrete problems of the Bolshevik Party, at home and abroad. Mr. Leites has depended not merely on the direct formulation of general rules of political practice but has also extracted them from particular proposals and decisions and from remarks addressed to very concrete and immediate problems. With a sharp eye for nuances of meaning, and a subtle mastery of the details of Bolshevik Party history and of the history of the Soviet Union in both its domestic and foreign relations, Mr. Leites' small book is a noteworthy moment in the history of the legend of the Soviet elite. With it, the legend no longer has an excuse for being.

One of the chief elements in the legend of the Soviet elite has been the argument that they would and could live in a state of rest vis-à-vis other states if they did not have grounds to suspect that those other states were plotting to make war against the Soviet State in order to destroy it. While he does not attempt to trace the psychological and historical factors underlying this fear, Mr. Leites shows that this pattern of thought dominates the outlook of the two main leaders of Bolshevism. For the Bolsheviks, Mr. Leites argues, there are only friends or enemies; intermediate or neutral groups cannot exist. "Any group which is not controlled by the Party, both at home and abroad is an enemy.... The only good neighbor is the absolutely controlled neighbor." Friends are defined so restrictively that only those who place themselves under the organization and intellectual control of the Party may be regarded as friends, and even then without complete reliability. Now, in the mind of the Bolsheviks, enemies do not merely attempt to maintain their own strength or preponderance, they aim "unceasingly at the annihilation of the Party." Moreover, all of the ostensibly separate acts of outside groups (which are perforce enemies) are part of a conspiracy—they are all governed by one master plan. Although conflict was endemic in any situation in which Bolsheviks coexisted with non-Bolsheviks, the threat to the Bolshevik elite was not so great as long as there were numerous enemy groups which could be in conflict with one another; with the rise to preponderance of one of these powers, conflict is inevitable.

This fundamental article of belief is expressed in the fear that in any relationship into which the Party enters with an outside group—another party or state—"it must 'use' that group or itself be 'used' by it." To permit the Party to be "used" by such an outside group is equivalent to the

[1] Nathan Leites, *The Code of the Politburo* (New York: McGraw Hill, 1951). Pp. 100. $3.00.

toleration of a permanent threat of annihilation; any "reliance" on other groups, on the good will of other groups, lays the Party open to the danger of manipulation by the other side. Hence, all forms of collaboration between the Communist Party or the Soviet Union on the one hand, and foreign states on the other, present the danger of penetration by the enemy, weakening and annihilation.

Collaboration must either be avoided or dominated by the Bolshevik elite. Where a collaborator cannot be dominated and must for the sake of the preservation of Bolshevism be accepted, no confidence can be reposed in him. He must be penetrated and manipulated—otherwise the relationship will take the reverse form with all its inherent dangers.

The scientific pretensions of Bolshevism, its belief that the major outlines of the course of events can be predicted and its belief in the identity of domestic and foreign politics, render changes in this pattern of expectations unlikely. An enemy remains an enemy unless annihilated; he remains an enemy even during periods of expedient collaboration. The Bolshevik elite must always be on the alert against an attack throughout the entire foreseeable future, i.e., until it controls all outside groups and renders them incapable of "using," manipulating or annihilating the Party, or the Soviet State. Moreover, although the general outlines of the enemy's intentions are discernible through the instrument of Marxist analysis, the specific balance of force and the outcome of the conflict in each concrete situation "can only be ascertained by the test of battle (whether violent or not)." This means that the Party must always probe the defenses of the enemy to discover his intentions and capacities in the immediate situation. This persistent probing will necessarily generate a state of tension.

No basically new elements can enter the situation to affect the basic disposition of one's enemies and to necessitate anything more than temporary variations in the tactics and short-run strategy of the Party. Technological and economic changes might alter the intensity of the enemy's hatred of the Soviet Bolshevik elite. It cannot change its direction. Sometimes, the Party will have to retreat, but periods of retreats are not times to rest; they are occasions to regroup the forces of the Party and to make ready for another advance when the propitious moment arrives. Whatever gains the Party or the Soviet State has ever made can be retained only by "intense 'struggle' "; new gains can be achieved only by the same means. No significant change comes by a gradual imperceptible process which involves no deliberate effort but only as the result of engaging the enemy restlessly and continuously. "The Party must cease its attempts to advance if and only if previous experiences have unmistakenly shown that it would be wasteful or dangerous to continue." Some occasions for advance are more favorable than others, and the Party must constantly be on the lookout to discern and seize them. Furthermore, the tactics of advance may vary with the situation—"assaults" may alternate with "sieges" or even "detours." Small gains in the maximization of the security of the Bolshevik elite and in the realization of communism must not be neglected.

The need for incessant alertness, for testing the enemy, and for readiness to go onto the offensive whenever the situation appears favorable and the belief that genuine neutrality vis-à-vis the Party or the Soviet State is impossible means that there can never be a period of relaxation. Pressure must be exerted continuously and by any means which are appropriate to the end of defeating the enemy. In this process, the Bolshevik elite must never be constrained by considerations of dignity or morality and least of all by emotional moods. While any of these attitudes may be simulated as an instrument in the political conflict, to take them seriously would be a grave deviation from Bolshevik principles.

This perpetual state of readiness to do battle, politically or militarily, does not mean that the Bolshevik elite expects to be always on the offensive. Setbacks, slowing up of pace, even periods of collaboration, of "people's front" tactics or of collaboration among the "peace-loving" states are conceived as definite possibilities.

What will appear for the outsider as such a period of relaxation will only be a period of consolidation of gains which have just been made or time for re-assembling one's strength in order to prepare for a new offensive. In its attempts to advance, the Bolshevik elite must always retain the initiative. It must never be "provoked," it must never be led into "adventurism." To be the victim of provocative tricks is one of the greatest defects a Bolshevik can have; equal to it is only the lighthearted undertaking to "risk already conquered major positions for the sake of uncertain further gains." Just as they must not allow themselves to be provoked into an adventure which they cannot carry off, so Bolsheviks must not (according to their principles) be inhibited by pride or vanity from retreating where it is necessary. "Mastery in the skill of retreating is as necessary as mastery in the skill of advancing. 'When it was necessary—according to the objective situation in Russia as well as in the whole world—to advance, to attack the enemy with supreme boldness, rapidity, decisiveness, we did so attack. When it will be necessary, we will know how to do this again and again. . . . And when in the Spring of 1921, it appeared that the advance guard of the revolution was threatened by the danger of becoming isolated from the mass of the people—then we resolved unanimously and firmly to retreat. And for the past year we have in general retreated in revolutionary order. Proletarian revolutions . . . will not be able to fulfil their tasks without combining skill in . . . attack with the skill in retreating in revolutionary order'." Furthermore, there are no prior limits imposed in the code of the Bolshevik elite on the extent of retreat. It may be of whatever magnitude is necessary to avoid the annihilation of the Party or the total loss of state power.

Like retreat, compromise is also a possibility in the code of the Bolshevik elite. It is not, however, to be thought of as more than a temporary expedient, like retreat, in the pattern of restless striving to achieve the perfect security of universal domination. It is justified "when an attempt by the enemy or by the Party to advance by violent means has failed." The Party regards it as inevitable that its partners to the compromise, foreign states or parties, will violate the agreements and, from its own side, it regards any agreement with an outside group as an aid in the future liquidation of

these groups and as a barrier against the liquidation of the Party by them. Mr. Leites cites, illustratively, a crucial passage from the vast documentation which he will present in his larger volume: " 'Reformism,' 'the policy of agreement,' and 'particular agreements' are different matters. . . . With the Mensheviks, agreements are transformed into a system, into a policy of agreement; while with the Bolsheviks, only particular concrete agreements are agreeable, and are not made into a policy of agreement."

This brief simplified summary of a very remarkable book does not adequately exemplify the rigorous systematic analysis on which it is based. Nor does the lucid elegance of Mr. Leites' own exposition reveal the arduous scholarship which underlies it. It is sufficient here only to indicate that the great legend which has possessed so many Western minds for so many years has never been more convincingly confuted. Although the implications of this analysis are not comforting, it also supports the conclusion that war is not inevitable and that skilful and resolute statesmanship can avoid it indefinitely.

The pleasant solutions of the difficulty of dealing with the Soviet elite, for which so many have hoped, receive little support from Mr. Leites' analysis. The image of a harmonious world order where no interests diverge sufficiently to arouse conflict or war is incompatible with the main tenets of Soviet thought. The possibility of winning the confidence and friendship of the Soviet elite by a policy of generous economic aid does not recommend itself in the light of the deeply rooted Bolshevik fear of being "used" or manipulated by other groups and of the conviction that the only friends of the Party or State are those who are completely dominated by it. The proposition that the abrogation of civil liberties in the Soviet Union is the product of a state of scarcity and of a realistic fear of attack from the outside, and that material amelioration would lead to the liberalization of the Soviet regime is implicitly denied by the Bolshevik classification of the entire political universe into friend and foe and by its extraordinarily broad definition of foe. The possibility of international control of atomic energy, which experience itself has now shown to have been a vain hope, is now also shown to be unreconcilable with the deepest Soviet convictions concerning the nature of the political universe.

Those who believe that Western Europe can find security in a policy of neutrality will find no confirmation in Mr. Lietes' clear analysis of the Soviet elite's intolerance toward neutral states. On the other hand, those who fear that American and Western European rearmament will "provoke" the Soviet Union into a war which otherwise might be avoided might have their fears allayed by Mr. Leites' succinct depiction of the Bolshevik principle of refusal to yield to provocations and to overcome feelings of injury or indignity. For as far into the future as we can dimly see, the West can allow itself no relaxation. The possibility of the temporary easing of certain tensions by negotiations is not automatically ruled out, but the classical form of negotiation is not to be regarded as a panacea, given the absolute distrust of the Bolshevik elite of every outside group. The West cannot justifiably and realistically hope to achieve an "enduring settlement" which will be definitively accepted by East and West and which, once achieved, will allow the West to pursue more congenial ends. It must expect unremitting pressure, and it must not be lulled by temporary mollifications of tone and action on the part of the Bolshevik elite. The clarification of these possibilities is one of the numerous merits of Mr. Leites' little book, which, by demonstrating the value which a scholarly understanding of history can have in the guidance of policy, has recalled political science to its great vocation as the counsel of princes. It adds a sober voice to the Great Debate.

Wigner: Impact of Atomic Energy on the Sciences

(*Continued from page 69*)

those who participated in it a very deep sense of the power and scope of our science. The experience is, in a sense, similar to that of Newton's lad picking up pebbles on the seashore, except that we recognize so many of the pebbles. The concerted efforts of large groups of scientists enabled them to foresee essentially all the behavior and all the complications in the functioning of two such novel types of machines as the nuclear reactor and the fission bomb. Even some of the most courageous and most far-sighted scientists sincerely doubted that this would be possible; yet it came to pass. This gave us a very deep conviction of the magnitude of our knowledge.

While the experience just described might have given us an exaggerated sense of the power of our knowledge, the realization of the many parts of the knowledge which went into that foresight, and of the very small fraction of that knowledge which anyone has mastered individually, restored some of our humbleness—even made some of us despair. The reaction of the scientists to these impacts covered a wide spectrum. On one side of the spectrum was the trend toward the attitude that it is hopeless and purposeless to be physicists in the sense of knowing physics, that all we can hope to accomplish is to be specialized researchers with interest in a very narrow field. There was a tendency, soon after the termination of the hostilities, to make this field so narrow that even nuclear physics was excluded from it—a tendency which fortunately has not prevailed. However, the opinion was not uncommon that as large parts of physics as possible should be forgotten, that we should have as little as possible to do with anything but research on the questions which appear most fundamental and that, in particular, all should be scorned that smacked of engineering or applied science.

The trend on the other end of the spectrum was set by those who were deeply impressed by the multitude of the branches of science which they had seen to function and by the realization that it would always remain impossible for them to master more than an infinitesimal part of even their own discipline. Nevertheless, they felt it to be a worth-while purpose to maintain an acquaintance and an interest in as large a part of their discipline as they could, the parts of particular interest being determined, to some degree, by their usefulness. They remembered that the work of many scientists, from Lavoisier to Einstein, has maintained at least some contact with practical life.

It is possible that the increasing growth of science and the consequent need for specialization will not permit the ultimate survival of the trend at this latter end of the spectrum. That followers of it will be badly needed in the near future seems unquestionable.

AMERICAN POLICY: EUROPE AND ASIA

RAYMOND ARON

Professor Raymond Aron is equally distinguished as political analyst, philosopher, and sociologist. In addition to important works on the philosophy of history, contemporary European society, and the deeper trends of French political life, Professor Aron writes with great perspicacity several times weekly in "Figaro." In November and December he was in the United States on the invitation of the Institute for Advanced Study at Princeton, and on his return to France he wrote a series of articles on the background and problems of American foreign policy. Extensive extracts are reproduced here by courtesy of the "Manchester Guardian" and M. Aron.

ALL, SAVE HONOR

COALITIONS are always shaken by defeats. The greater the peril, the more the temptation to mutual recrimination grows: yet the more imperative is the duty of standing firmly together. The Atlantic alliance bears within it germs of weakness, the elimination of which is not entirely dependent on human effort. The disproportion in strength between the Old and the New World is paralyzing the rulers of Europe, who are leaving the initiative and the responsibility for grave decisions to the Americans, though after the event they sound the note of retrospective wisdom all the higher.

In the last resort, too, the partners in the alliance do not stand equally to lose. The fault lies not with men but with geography. Nobody knows how a third world war would be fought, nor who would bear, in the end, the heaviest burden. Nevertheless, each country faces a future that differs from its allies' according to their respective geographical positions and resources. On the other side of the ocean, thousands of miles away from lands under the shadow of the MVD (the old OGPU), a third world war is thought of with horror, but also with determination and with a sort of spontaneous conviction that once again one will come through it victorious. For Europe, if total war comes, there can be no question of victory. At best, after the defeat of Soviet imperialism, and after unforeseeable destruction and disaster, a hope of recovery. Every acute crisis arouses here an anguished sense of approaching catastrophe and an almost instinctive desire to appease the monster.

Everybody knows that since the demobilization of the Anglo-American armies in 1945 there has been no armed force in Europe that could hope to break up an assault by Russia's divisions if Stalin were suddenly minded to give them the fatal order to attack. This is a situation which has existed for years, and it may continue for years still. For everybody knows, too, that the crossing of the demarcation lines by Stalin's armies would call down an immediate atomic retort and the outbreak of universal total war.

"Interposed Satellites"

It is not known how long the men in the Kremlin will continue to avoid a general war. But at the moment there is nothing to suggest that in this respect their aims have changed. China's intervention in Korea, unsupported by the Soviet Far Eastern air force, is merely the old technique of "interposed satellites," unless, of course, it is an expression of China's own imperialist aims. . . .

Stalin's intentions are, of course, only one element in the situation. Since June 1950, and still more since November 1950, the momentum of events has been in danger of getting beyond men's control, even the most powerful among them. But Europe is and will remain the marked prey wherever in the world the conflagration is accidentally lit. We must learn to live in the shadow of a permanent danger. To show panic would be to play into the hands of the enemy.

The bitter criticisms of the United States that are being made on so many sides are not only unjust but are undermining the last chance of freedom by sapping the unity which holds together a defenseless Europe and the American Republic with its immense and intact resources.

Let me not be misunderstood. There will be no question in these articles of glossing over the truth. What has been most lacking in the relations between Americans and Europeans has been the courage to speak frankly. United States policy has brandished too many statistics and too few armaments: it has accumulated too many millions of tons of steel on paper and not enough soldiers and tanks in practice. Battles are not won, even against a second-class power, by "power potential." No diplomacy, whether in opposition or in negotiation, succeeds without the means to assert itself. The atomic bomb has been the Maginot Line of the United States. It has given Americans a false sense of security from which they have been abruptly awakened to find themselves almost alone in an enslaved or powerless world.

But, having taken account of these mistakes, one must add that America's allies, who are at least as closely threat-

ened, are scarcely in a position to preach at them. We, no more than they, have kept clear of the Asiatic morass. No more than they, have we begun to mobilize our resources. Let our knowledge of our common aberrations bring us closer together, this time for a common effort, instead of losing us in sterile quarrels.

Fighting for Freedom

The world into which mankind is slipping knows no other laws than those of might and of deception. Hitler and Stalin do not content themselves with exterminating their enemies; they load them with insults, they dishonor them, and pursue them into the grave, so that posterity may learn to curse the vanquished or in the end forget them altogether. Trotsky has disappeared from the Stalinist records of the Revolution of 1917. The world which we are desperately trying to save is not that in which wise men scrutinize the omens of success, and events determine their validity. It remains true, whatever happens, that in Korea the United States is fighting not only for itself but for the freedom of the peoples of mankind.

Because fortune has momentarily betrayed American arms, it might be supposed, judging from what some people are saying, that, to use Mr. Molotov's phrase in 1940 at the time of the Russo-German alliance, the idea of aggression has changed its content. They are strange imperialists, those soldiers whose supreme ambition is to leave the country into which they came to do battle. It is a strange imperialism, that of a republic scattering dollars all over the world in the naïve but generous hope of setting up a barrier of prosperity against the conqueror. Yes, serious mistakes have been made in the conduct of military operations. Perhaps imprudently, the American divisions went to Korea to defend what the French called not so long ago "collective security against aggression." The setback probably marks the ruin of the United Nations just as the Ethiopian affair was the end of the League of Nations. Let us register the facts, but let us also continue to call a spade a spade. To lose one's sense of values is to accept slavery in advance.

For centuries past generations of Frenchmen have learnt to respect the phrase uttered by a king of France after a great defeat. "All is lost—save honor." The day that idea becomes absurd we shall no longer know why we are fighting. Even if all was lost in Korea, nothing would be lost in the world. The outcome of a local conflict does not determine that of the world struggle.

THE LIMITS OF THE UNITED NATIONS

Korea unavoidably brings Ethiopia to mind. In both cases a Great Power, Great Britain before the Second World War and the United States today, endeavored to bring into play the mechanism of collective security. In both cases the aggression was patent, glaring, on any principle of international morality. In both cases the concrete facts were arguable: Ethiopia is not exactly what one would call a modern state, and in Korea the aggressor and the victim belonged to one and the same nation. In both cases the enterprise ended in total failure, though for different reasons.

From the day when the United States decided on military intervention it entered a strange world, torn by the contradiction between the principles of a universal organization and the realities of power politics and of a conflict between two coalitions. Nobody questioned the fact that the Korean aggression was inspired by Moscow. But this could not have been proclaimed without severing the relations with the Soviet bloc which, it is said, it is the function of the United Nations to maintain.

The principles in the name of which military action is justified interfere with diplomatic action. Posed in terms of traditional policy, the Korean question was relatively simple. The Soviet Union had decided to restore the unity of the country by force of arms. The United States decided on armed resistance.

Three Solutions

From the first, three solutions appeared possible. Was the Soviet Union so afraid of an immediate general war that it would allow the operations to proceed without coming to the aid of its satellite? Or was it ready to run any risk in order definitely to expel the United States from the Asian continent (and in that case the issue would not be in doubt, such was its military superiority, alone or with the Chinese, in that region of the globe)? Or, finally, did it not want an extension of the war but would not agree to complete defeat, by which it would lose face, and in this case a compromise was likely which would more or less reestablish the position as before.

This last solution would, in principle, be scandalous. In practice it was, perhaps, the least bad solution for which the United States could hope, given its unprepared state. The United Nations was not so much an intermediary between the protagonists in the drama as a stage on which the play took place. It incited all the powers to take up extreme positions, in virtue of the huge publicity, the symbolic importance, given to events by their being brought before the Security Council or the General Assembly.

The League of Nations did not permit the formation of an effective alliance against Hitler or Mussolini. The United Nations offers little more chance against the Soviet Union and its allies, so long as the defenders of international morality have only an industrial potential, superior on paper but not yet mobilized, and a stock of atomic bombs which are the only present protection of the West against the threat of a complete catastrophe.

It would obviously be absurd to attribute major responsibility to the United Nations. Neither for good nor for evil can an international organism exercise such influence over the course of history. What we can say is that the United Nations, like the League of Nations, was put to the test under unfavorable conditions. To represent the Chinese Communists as gentle agrarian reformers, or to announce a Chinese Titoist policy ahead of time, was to ignore the facts or to indulge in wishful thinking, but it would be no less absurd to confuse the China of Mao Tse-tung with the satellites of Eastern Europe.

Whatever authority the Politburo in Moscow may have over one or another of the leaders in Peking, and whatever may be the Stalinist orthodoxy of the new regime in China, that regime cannot, by virtue of the very size of the country and the exacerbated nationalism of the population, be totally controlled like the European People's Democracies. In relation to Asian communism, Stalin is more the pope or prophet than the temporal leader.

Chinese Imperialism

It is, of course, almost certain that Chinese expansion in Korea, Tibet, and Indo-China has been planned with the men of the Kremlin and has been given approval and a promise of support in case of need. But, though for lack of reliable information nothing can be definitely stated, it looks as if the West will be confronted in the future with an entirely independent Chinese imperialism collaborating with Russian Soviet imperialism.

North Korea was a satellite of Russia

before the events of June. All the Russian instructors and commissars disappeared after the American successes of September. So far they have not reappeared. Korea is in process of becoming a satellite of China. Similarly, the most faithful of Mao Tse-tung's armies, the Fourth Route Army, has moved into Manchuria, which in the past was under the direct control of the Soviet Union. Once more, it would be a mistake to infer that that result was the objective of the Chinese action, or that the change in relative strengths in Manchuria is evidence of virtual tension between Moscow and Peking.

For any appearance now of the Sino-Russian rivalry visible in 1945–46, at the time when Stalin's troops were dismantling factories in Manchuria, it would be necessary for the ideological solidarity to be effaced and for the two great communist powers not to be at grips with a common enemy. A Chinese Titoism may make its appearance when the West has retired from Asia, but it is very doubtful whether it will appear before that time.

Consequently, all retrospective discussions or recriminations concerning mistakes made since June lose much of their importance. The fundamental data would in any circumstances have been the same, and would have faced the West with the same alternatives.

In Europe, except in Greece, Soviet imperialism has not had recourse to civil war since 1945. However enfeebled the democracies of the Old World may be, west of the Iron Curtain they still have sufficient police resources to maintain order. The populations, and even the section favorable to communism, would not agree to the use of the techniques employed during the last war against the occupation authorities.

In Asia, however, the organization of armies of liberation, led by communist activists recruited especially among the peasants, is the recognized tactics, the official injunction of Asian communism. At the trade union conference in Peking last autumn there was a formal announcement of the extension of the armed struggle throughout Southeast Asia. It may be that the independent governments of Burma, Indonesia, and India will succeed in holding in check the "armies of liberation." Where those armies are directly at grips with a European army, and are mobilizing anti-European (or anti-White) nationalism for their benefit, it is impossible to see how the colonial power can carry the day.

Only one uncertain point remains: would it be possible, as in Europe, to isolate the different Asian countries? Would the Chinese armies be prevented from crossing international frontiers, as the Red Army was in Europe? Would the conventions of the cold war be imposed? Would the support given to the "revolutionaries" in the interior of the different countries be indirect and limited in Asia as in Europe? This question was obviously decisive; and today it has been given an answer that could not be clearer.

Since the Chinese armies have crossed the Yalu to fight the American divisions, nothing will prevent them from one day crossing the frontiers of Indo-China, Siam, Burma, Malaya, and even, a little later, India. From now on it is no longer clear how any country in the Asian continent could be defended, apart from those that have sufficient local forces. The threat of strategic bombing and of general war, at present the only weapon of the United States, has not impressed Mao Tse-tung and has proved in the event to be a bluff.

Why has the threat been ineffective? Because American hesitation before crossing the 38th parallel reassured Peking on Washington's intentions? Or because Peking was determined in any case to "chance it," and the men of the Kremlin are much more ready to face a general war than the Western strategists have imagined? No one can say with certainty.

Personally, I am inclined to think that the communist regime in China as elsewhere is more anxious for expansion and imperialism than for economic reconstruction. And the men of the Kremlin, considering the map of the world, and well informed as to American unpreparedness, are not frightened either by the threat of general war or even by the atomic bomb. . . .

If the present difficulty compels immediate measures to be taken, it may do some good. To make an end of diplomatic fictions, and not to be misled by the grandiose vocabulary of the United Nations, to count divisions, and to mobilize the available resources of the free world, this desperate realism, so close to simple good sense, offers the last chance we have of salvation.

POWER AND UNPREPAREDNESS

The United States is the greatest industrial power not only of our time but of all human history. A population of 150 millions, about 6 per cent of the population of the world, consumes alone more petrol and manufactures more automobiles than the rest of the world put together and, in general, produces almost the same quantity of manufactured goods.

If we compare the United States with the Soviet Union, the former has an overwhelming superiority in industrial potential. To keep to essentials, the United States annually produces almost five times as much electric energy, extracts twice as much coal (and could, if necessary, extract nearly three times as much), and produces nearly four times as much steel as the Soviet Union.

Military Strength

But economic statistics, like the atomic bomb, have for too long given the Western world a false sense of security. It is true, as has been stated over and over again, that industrial potential is essential to modern military power. But it is not the only basic requirement, and there is no constant relation between industrial potential and military strength. In peacetime a decisive factor is what may be called the coefficient of mobilization. It is excellent to turn out a hundred million tons of steel from the blast furnaces, but we need also to know what fraction of that steel is devoted to armaments. Last year armaments production in the United States accounted for between one and one-and-a-half million tons of steel. In other words, the coefficient of mobilization was scarcely more than 1 per cent. Nobody knows the corresponding figure for the Soviet Union, but it is not difficult to imagine what it might be, judging from the output of tanks and aircraft. The United States manufactures twenty times as many motor vehicles as the Soviet Union, but in 1949 the latter manufactured much more than twenty times as many tanks as the United States. More than ten thousand times as many automobiles as tanks issued out of American factories: more than six million automobiles, less than six hundred tanks.

In aircraft the United States is not so completely unprepared. But it will be impossible to produce at a rate comparable to that of the last war before an irreducible period of time has passed. Within eighteen months from now the results will be impressive. The maximum will be attained within two or three years.

When the Korean crisis broke out, the strength of the American army was 593,000 men, the navy 382,000, the air force 411,000, and the marines,

74,000. The estimated strengths in June 1951 will be respectively: 1,264,000; 688,971; 651,000; and 166,000—in all, 2,800,000 men under arms.

Without entering into the details of the American military system, which would seem very complicated to people used to conscription, it may be said that some hundreds of thousands have been called up into the three services. There is no reason why more should not be called up except that there would be nothing to equip them with. Further, a high proportion of the officers and NCO's on whom the army relied as training cadres to build up the new divisions—the aim being to have 25 in 1951—was sent to Korea.

But the number of men does not give a correct idea of the number of available divisions, which is not more than ten. Six divisions, along with one of marines, are involved in Korea—in other words, three-quarters to four-fifths of the actual American army. The lack of proportion between the number of men and the number of divisions is related to the organization and the conception of the Armerican army. In a recent interview General Clark, who commanded the allied troops in Italy, stated that for every 19,000 men in a division there were 60,000 in the rear. In the Soviet army, he added, the proportion was the reverse.

Noncombatants

It may be that in certain respects and on certain battlefields this accumulation of auxiliary services adds to the power or mobility of the fighting arm. But there are plenty of military experts who are disturbed by this prodigal use of manpower. It is true that in industry the proliferation of administrative services responsible for working out and rationalizing production results, in the end, in an increase in individual productivity. It is feared, however, that the analogy is not entirely sound for the army, and that the horde of noncombatants is, at least in part, the equivalent of a phenomenon familiar in military history: the armies of rich nations, in order to insure certain living standards to their soldiers, encumber themselves with ever increasing camp baggage.

This brings us to a serious question, not as to the industrial potential of the United States, which is the highest in the world, but as to the maximum coefficient of mobilization. The part of a nation's resources which is used for its war effort depends, in effect, on the sacrifices to which its population is prepared to agree or which its government is ready to impose. Everybody knows the privations which the Soviet leaders are capable of inflicting on the Russian people. I think, for my part, that the American people, if the worst came, would recoil from no sacrifice to win, that is to say, to survive. But neither in the First nor in the Second World War did it experience war in the way that the Europeans did.

The power and flexibility of the industrial machine are such that between 1939 and 1945 civil consumption increased, although the United States was manufacturing a hundred thousand aircraft, tens of thousands of tanks, the necessary equipment for ninety American divisions, and was sending tens of thousands of millions of dollars' worth of raw materials and war equipment to Russia (ten milliards), Great Britain, China, and so on. No doubt certain industries, such as the automobile and radio industries, were working entirely for the army, but the available quantity of certain goods, such as food and clothing, actually increased during the hostilities.

The United States waged the last war by mobilizing its surplus manpower and expanding its productive capacity. If it had to fight a war against the Soviet Union, it would be in the front line; it would bear the heaviest burden, and it would be unable to count, as before, on a massive superiority in numbers and firepower.

The Americans have an unrivaled industrial capacity, but there are only 150 millions of them. If the Soviet Union added the Western European potential to her own and to that of the satellite countries, the total on paper, would be nearly comparable to that of the Anglo-Saxon world. The Russian superiority in numbers would then play its full part. The contrast between the inferiority in numbers and the superiority in technical quality is at the root of a strategic concept which has not been adopted by the Pentagon, but which has many supporters in it. Some theorists recommend a reliance mainly, if not exclusively, on airpower. "We have no chance of winning in a land war," one of the editors of the biggest American magazine told me. "We shall never be able to bring as many divisions into the line as the Soviet Union, backed up by Eastern Europe and Communist China could bring. We should be playing the enemy's game if we fought him on his own ground. In any case, even if by some miracle we won in the end, we should be exhausted, as France was after the first war and Great Britain after the second."

In the twentieth century, America has waged rich men's wars, prodigal of machines but thrifty with blood. It is not surprising that they do not want to break with the tradition, but it is not certain that they can avoid doing so. Peoples always pay dearly for power, even if they do not love it.

The resources of the United States are immense, and in the long run, probably decisive. But it is necessary also that they should be mobilized for freedom as completely as the resources of the Soviet empire will henceforth be mobilized for conquest.

POLEMICS AND PERSONALITIES

If one were to take everything said in the course of the electoral campaign literally, we should have to conclude that American opinion is deeply divided on foreign policy. Europe or Asia, appeasement or resistance everywhere and at any price, anti-Communist crusade or isolationism—these alternatives are debated with an extraordinary mixture of fervor and confused thinking.

The unity of the nation seems to me to be real and solid in spite of these polemics. Nevertheless, it is true that they reveal a division within the country, which is examining itself both on the past and on the future. "How have we got into this state? What are we heading for?"

It is not long since Franklin Roosevelt was idolized; now he is becoming a whipping boy. But even supposing that American policy toward Russia in the years 1943 to 1945 is unreservedly condemned, who has a right to bear judgment? Were the Republicans hostile to the concessions made to Russia when her intervention seemed necessary in order to spare American lives? Did they protest against the demobilization in 1945? Was public opinion any more farsighted in France or in Great Britain? Was it any freer of illusion? Had it any better understanding of Stalinist ambitions and Stalinist tactics?

Heroes and Scapegoats

The motives of these retrospective polemics are understandable, but their usefulness, I fear, is nil. One of the most disconcerting characteristics of American public opinion is its tendency to combine hero worship with hunts for scapegoats. Mr. Marshall and General MacArthur are (or the General, perhaps, was) sacrosanct. Mr.

Dean Acheson is the villain of the piece.

The criticisms of General MacArthur in Europe have been so excessive that one is tempted to take up his defense. But what is at issue is not simply the question of the merits or defects of a general. The hero worship surrounding MacArthur is a factor restricting the President's freedom of action. The President authorized the last offensive, in spite of the contrary advice of his civilian advisers, partly because he relied on the military commander on the spot, but also, at least unconsciously, because he was afraid of the clamor MacArthur's friends would raise.

Even more striking, perhaps, is the case of General Marshall. He inspires respect and admiration in all who come into contact with him. I have no intention of overthrowing an idol. But, after all, if we are to go philosophically into past history, General Marshall bears some of the responsibility for the two decisions for which the administration is most reproached. When, at Yalta, President Roosevelt urged Stalin to break the nonaggression pact concluded between the Soviet Union and Japan, and when he offered him in return Sakhalin and the re-establishment of Russia's special rights in Manchuria, he was largely following the advice of his military advisers, according to whom the war against Japan was likely, in the absence of Russian participation, to go on for months and to cost hundreds of thousands of lives. General Marshall was the chief of those military advisers. It was also he who, on his return from China, advised giving priority to Europe and abandoning Chiang Kai-shek to his fate. I do not suggest that he was wrong. Perhaps it was impossible to prevent the Communists' victory in China. Perhaps more direct intervention would have bogged the American forces in the Asian marsh. In any case, it is neither just nor reasonable to hold the Secretary of State (Mr. Acheson) solely responsible for mistakes made (if mistakes they were) by the whole administration, including the heroes.

I do not know what the exact part played by Mr. Dean Acheson was during the years 1943–46. But since he has been Secretary of State, he has belonged to the "tough" school and not to the "appeasers"; he continually advised a rearmament effort at a time when the economy cry was being listened to by members of Congress who were not always Democrats. For the last eighteen months he has tirelessly denounced the mortal danger to the democracies which Soviet imperialism represents. Words, of course, are not enough, and the Secretary of State may be accused of having failed to insist on the resources required by his policy. But how many Western statesmen would escape from the criticism?

Emotionalism

American opinion, judging by the press, the radio, and political quarters in Washington, is extraordinarily emotional. People pass from excessive optimism one day to bottomless depression the next. Defeats are not merely reported, they are magnified and given six-column headlines in the newspapers, in which disasters, present and to come, real and imaginary, are described with admirable but excessive frankness.

The same emotionalism is found in the tendency of the public, of critics, and of politicians to think in wholesale terms. Anyone who three years ago advocated vigorous diplomacy in Asia continues to do so today, whatever the circumstances and whatever has happened. It might have been reasonable to defend China in 1946, but it does not follow that one should wage war against Communist China in 1951. It is excellent to have no illusions as to the results of negotiation with a totalitarian state. But there are cases in which, for lack of available resources, negotiation is the least bad method of covering up a local retreat.

Slogans are freely brandished—appeasement, Munich, international morality—without any exact idea of the meaning of these phrases. The abandonment of Eastern Europe has been the Munich of the Old World, and the abandonment of China the Munich of Asia. Since then the West has been resisting with its back to the wall. We need to know that further concessions will not stop further demands or adventures on the part of the Stalinists. But it does not follow that we must fight everywhere all the time with the choice of terrain and of the moment left to the adversary.

Those responsible for the administration are not fooled, of course, by these simplifications. But they swim in the atmosphere created by the press and the radio. In the long run, the policy they adopt is often a compromise between their judgment and public pressure. All democracies should give their rulers a certain freedom of action. In Great Britain national discipline is such that the Opposition generally permits the party in power freely to follow its chosen path. The principle followed is that the worst of all policies is not to have one, or to hesitate between several alternatives. In grave or exceptional circumstances the revolt of public opinion forces the Cabinet to change its course, as it did, for example, after the seizure of Prague in 1939.

American democracy is different. The opposition makes itself heard on every occasion. The different groups campaign in favor of their protégés, their interests, or their conceptions. When no agreement is reached between the two parties, the wish to secure a majority in Congress drives the administration to make some concession to its opponents. In domestic politics this method of compromise works satisfactorily. In foreign affairs it results sometimes in the adoption of a middle course which no one approves and which has all the disadvantages of every policy. To support Chiang Kai-shek, not enough to save him but enough to earn the enmity of the Communists (which would probably have been earned in any case), is as understandable as it is difficult to defend. I do not claim to suggest what should have been done in Asia. I would merely point out that polemics, retrospective or with current application, are among the most important data from which the President has to make his decisions.

The American nation is by nature optimistic, resolute, and confident, and on it rests the hope of the West. It has faith in the future and in its strength, and in the possibility of resisting and, if the need arises, of winning. Even the fury with which it is sometimes filled when its pride is wounded should, in certain respects, be placed to its credit. Without wrath and without faith the will to fight is blunted. It is also necessary that excess of confidence should not lead to misjudgment of relative forces or to the imputation of responsibility for reverses onto the leaders alone. The United States is capable of much, but not of everything.

The undeclared war which the

American Republic is waging throughout the world for the common salvation of the West requires strength, courage, and determination; but it also calls for coolness and adaptability.

THE SPIRIT OF A CRUSADE

The memoirs of General Eisenhower bear the title "Crusade in Europe." Twenty-five years earlier the American armies had come to the Old World moved with the same spirit—to make the world "safe for democracy." Disappointments, the feeling that the peace imposed on the enemy was not a just one and that the wartime allies were continuing to play the crooked game of power politics, quarrels at home, and the desire to be rid of it all, drove the American Republic back into isolationism. The crusade had failed, and the rest of the world was left to fester in its own corruption.

There was nothing of this after 1945. America was determined not to repeat the mistakes of the years following the First World War. The United Nations was to revive the hopes which the League of Nations had inspired a quarter of a century earlier; it was to take up again the work, interrupted by the war, of creating an international order of things subject to the rule of moral law. The extraordinary enthusiasm with which President Truman's decision of June 1950 was greeted in the United States was fed by the same aspirations born of a religious tradition. "Never have I been prouder of my country," was the usual plain American's view on June 27, 1950. One should make no mistake about it; the cause of this pride and the man-in-the-street's consent to a distant and hazardous expedition was not a calculation of ultimate gains or probable risks; it was not even a desire to take up the challenge thrown out by the Soviet Union; it was the sense of fulfilling a duty and placing America's power at the service of the divine cause of collective security against aggression.

Disadvantages

I am not unaware of the disadvantages of the crusading spirit. That spirit partly explains the way in which the last war was waged. The fight was against the Prince of Evil, and the countries allied with the United States in the just cause were automatically on the side of the angels. It was not easy to realize that the grouping of countries in the different coalitions was not a dress rehearsal for the Day of Judgment. Moreover, once it had been brought into the war, American diplomacy, like any other country's diplomacy, practiced the art of expediency. But American opinion never accepted the practice easily or without regret. The expedient of Yalta, the agreement with Stalin over the Far East, the consequences of which proved in the long run disastrous, is not criticized simply as a mistake in a "realist" policy but as a betrayal for which the people of the United States will pay dearly. It is easy to smile at what Europeans, disabused of everything, including their own ideals, would call naïveté. It would be wrong to forget that a Great Power, if it is to play its part in the world, must believe in a mission bigger than its own selfish interests.

Let us beware of repercussions. It is in Asia that the unity between Europe and the United States is being largely made and unmade; the worst mistake of British diplomacy between the two wars was, perhaps, the refusal to respond to Washington's appeal when in 1931 America wanted to stop Japan's adventures in Manchuria. And if American opinion gave up its idealistic fervor it would be ready for the other extreme—a withdrawal into itself and into cynicism.

At times during the last war Franklin Roosevelt seemed in conversation to feel more hostility to the British and French Empires than to the Soviet Union. Even in 1949, when M. André Siegfried wrote, and very justly, that the most revolutionary force in the world, particularly in Asia, was the industrial civilization which the United States was spreading, several of the most responsible American writers replied, "Yes, we do represent the most revolutionary force; yes, we have been, are, and shall remain hostile to colonialism in every shape or form; yes, the message we are spreading is that of freedom to govern oneself and to create an honorable existence through man's mastery of natural forces." The great tragedy, felt in a confused way by American opinion, is that the Asian revolution, which had its sympathy, and which it would have been glad to inspire, brackets Europeans and Americans in one and the same condemnation. The Asiatic revolution is a revolution against the whites, which the Russians have managed to benefit by and not to lose.

The American Dilemma

And in that is the tragedy in Asia, not only for the United States, but for the West as a whole. The United States was unable to decide on a policy in China because it hated communism and despised Chiang Kai-shek. It is hamstrung in Indo-China by a similar dilemma. An important section of the intelligentsia, more or less Westernized, in most of the Asian countries is attracted by the popular version of Marxism, which is a mixture of hostility to the West and of faith in the technique of collective action by the party and in the creation of an order adapted to the needs of a technical society. (Thanks to Oxford and Cambridge, and to British influence, the former possessions of the British Empire have an intelligentsia that is trying to graft into their traditional culture the liberal, and not the Marxist, ideas of the West.)

Undoubtedly, the most progressive industrial techniques belong to the United States and not to the Soviet Union. But the United States spread not only the dream of a prosperity inaccessible to the masses but representative institutions which are the luxury and the pride of Western societies but which in the Far East are put out of reach by the poverty of the people and the inexperience of their rulers. Condemned in spite of itself to an imperial role, the United States has conceived the ambition of spreading prosperity and political freedom through the world. Unfortunately, political freedom is not transferable; it is a tyrannical regime like that of the Soviet Union which breeds satellites, not democracy.

Certain countries whose resources are not too disproportionate with the number of mouths to be fed—Siam, Indonesia, and Burma—might be effectively helped by the West. Even here the new masters of Peking would have to refrain from inciting a growing proportion of the Chinese minorities to enter into the armed struggle. In any case, whether it is a question of administering economic aid or resisting the "armies of liberation" under Communist command, the first essential remains the same: it is necessary that the independent governments should succeed in controlling the nations they govern.

It is a strange paradox that the Stalinists, who claim to be the mouthpieces of Marxism, have recognized in Asia the greater importance of politics. It is true that they are carrying out agrarian reforms and rousing the masses by promising them economic improvement. But, essentially, they are introducing order, tyrannical certainly, but with the inestimable merit, in the present chaos, of being order. The West is continuing to act upon the

lessons of nineteenth-century Marxism: it is acting as if it believed in the miraculous effect of dollars. It forgets that the organization of the masses and the setting up of an accepted power remain the first requirement.

The public, disturbed at finding itself at war with its friend and ally China, has gone over to the other extreme. It takes stock of its trusted allies, and is upset by the mounting clamor of reproach from the Old World. The public notes the disproportion between the thousands of millions of dollars lavished abroad and the number of divisions offered when trouble broke out. "Yugoslavia has more divisions than the whole of Western Europe," an American told me with a grim smile. "She has not cost us twenty thousand million dollars." That was one man's comment, and it would be absurd to regard it as representative. Nevertheless, the present crisis risks separating the United States and Western Europe, the latter having the feeling of being dragged into a world conflict by American incaution and the former of being deserted by their allies.

The United States is too thoroughly involved in world politics to be able to withdraw into its own shell. But there is a widespread doubt of the effectiveness of the measures adopted so far. "After all," one of my audience said to me after a lecture to a group of business men, "why should we not let Stalin conquer Asia and Europe? Every empire that expands too far ends by crumbling away." "The Soviet empire will certainly end by crumbling away," I replied, "but the question is whether it would crumble before or after the fall of the United States itself." The rulers of the American Republic are aware of the peril, and they are still protecting the Old World from military aggression by the Soviet Union. There is, and there will be, no return to isolationism; but there is a feeling, which will grow stronger and stronger if the Old World continues to be weak, of isolation, since, in the event of total war, the Soviet armies will be able to go to the ends of the continents.

EUROPE AND THE UNITED STATES

The differences between the British and Americans over Communist China, and between the French and Americans over German rearmament, are part of the normal relations between sovereign states. Some of these differences may be accounted for by the very uncertainty of the situation: no one can either prove or definitely exclude the possibility of an agreement with the People's Republic of Peking. Other differences are accounted for by different estimates of the risks involved.

But it has to be recognized that, over and above these arguable differences, one finds an irreducible opposition for which men are less responsible than geography. The people, and still more the rulers, of the United States are conscious of the immense sacrifices which a world war would entail. They are aware that this time they will be in the breach from the first day, and that they will have no allies capable of bearing the main burden of the battles on land. But, in spite of all, in this struggle for existence they have no doubt that they have a chance of winning. They hope to avoid war, but they hope also to win it.

Europeans, and more particularly the French, regard war as total disaster. "There will be no victors, no survivors"—this remark of a Canadian Minister's fits the European state of mind to a "t." Unfortunately, as was our experience in face of Hitler, such a state of mind, though it may be inevitable, contributes much more to war than to peace. It encourages the tyrant to push on farther and farther with his enterprise, and when the conservative powers decide to resist, the disequilibrium is such that diplomacy no longer suffices.

A Sterile Reaction

The Europeans, or at least those among them who are not Communists, cannot but want two things—to avoid being subjected to Russia and to avoid war. To win the cold war meant precisely to limit the expansion of Stalinism without unloosing the monster a third time. When the Americans seemed to be winning the cold war, stopping the conqueror without recourse to arms, the Europeans applauded. Now that they seem to be near to losing it, forced into a disastrous retreat or into battle, the Europeans are alarmed.

This reaction, once more, is comprehensible, but it is sterile and fatal. Nothing can excuse confusion of values and the abdication of one's conscience. It may be that the Americans have been no more fortunate than the British and French were in 1933–39; it may be that they have not discovered the secret of a firm and peaceful diplomacy to place an impassable barrier in the way of the aggressive designs of a totalitarian regime. But does the secret exist? And if it exists, is it accessible to the democracies?

No doubt, if we go far enough back into the past, we come to moments at which it would have been possible to follow a different course. The conduct of the war adopted by the Anglo-Saxon democracies, the concessions made to Stalin because his help was needed in securing the unconditional surrender of Germany and Japan, and the demobilization of 1945–46 are clearly at the root of the present crisis. But such criticisms after the event are easy. Once total war had been started, how was its momentum to be arrested? Without the Second World War, half a century at least would have elapsed before Soviet Russia became a real peril. Even today the impressive fact is not so much the strength of Russia as the weakness of her adversaries (excepting the United States). Before 1933 neither in Germany nor in France were the Communist parties of sufficient stature to hold power. It needed National Socialism, with its crimes and its follies, to give Stalinism its opportunity. In fact, Hitler has been Stalin's greatest ally.

Since 1946 American diplomacy has done its best to hasten the recovery and the unification of Europe. The results obtained have been real, but limited. Have the Americans themselves been responsible for the limitation or the Europeans? The Americans are justly reproached for having failed in 1943–45 to realize that it was necessary to overcome the Third Reich but not to destroy Germany. Did the French realize this any better in the years that followed?

"Provocation"

There are journalists who revile the Atlantic Pact as if it were responsible for the tension with Moscow. It will be recalled, to begin with, that the initiative in this pact came from the Europeans, who wanted a solemn consecration of the United States' permanent presence on the Continent. It will be further recalled that the Cominform attacked the Western democracies not after the Atlantic Pact but after the beginning of the Marshall Plan. This point of departure is decisive: it shows that the Soviet Union saw "provocation" in the effort of the countries west of the Iron Curtain to reconstruct their economies independently of the Soviet empire. So long as Western Europe was vegetating in dire poverty the men of the Kremlin hoped to conquer it from within. On the day when Amer-

ican aid brought back hope to Europe they set in motion every weapon of the cold war.

It is quite right to say that the wisest policy is to talk softly and to hold a big stick in one's hand. For some years the West has been talking toughly, but has not had a big stick. The main fault, however, lies not in the tone adopted: we can never hope to equal Mr. Vishinsky in that. It lies in the stickless-ness.

The United States has gone wrong, especially in its timing. It expected the 1950 crisis in 1952. Two factors contributed to that miscalculation—the Soviet success with the atomic bomb two years earlier than Washington expected, and the Communist victory in China, which has upset the world balance of power. But, after all, the American strategists' gamble that the atomic bomb and the American potential would suffice to deter Stalin from steps that might provoke general war has not altogether been lost.

What *has* been lost is the illusion that it is possible to carry on a policy in opposition to Soviet imperialism at the four corners of the world and to continue with business as usual at home. In order to live it is necessary at present to forego the joys of living. In order to survive it is necessary at present to sacrifice part of the reasons for survival.

Liberal societies find it difficult to stand up to the wars, even the victorious ones, carried on in their name. Liberal values are peace values: wars, whoever wins, spread the taste for violence, fanaticism, the practices of authoritarian bureaucracy—in other words, some of the characteristics of the regimes we are fighting. The rulers of the United States are not unaware of this, but they have no choice. Some Europeans may imagine that the Soviet Union would have respected its neighbors more had the American Republic made a less vigorous exhibition of its hostility to Stalinism. The simple truth is that Western Europe would already have been covered by the Soviet flood if there had not been on the other side of the ocean a people still powerful enough to take up the challenge and declare itself ready for the fight. It is fair to reproach American diplomacy for many mistakes. To reproach the American people for being ready to stand firm would be to betray a sort of longing for surrender.

Will the United States, committed now for some decades to activity on a world-wide scale, succeed in arresting Soviet imperialism? And on what conditions? Will the Americans be able to live as in a fortified camp without losing their sense of freedom and of human dignity? Endowed with an industry unequalled in the world, but at grips with countless human masses, will the American nation consent to the privations and sufferings that have always been the price of greatness and are today the ransom to be paid for safety?

People like to talk of the hope aroused by Stalinism in millions of souls, a hope that is part of its power. Why not talk of the millions of allies possessed by the West on the other side of the Iron Curtain? How many French Communists will remain sincerely devoted to the Soviet idea when they have had lasting experience of the reality of Stalinism? Who form potentially the largest fifth column, the worshippers of the tyrant or those who, to the bitter end, whatever may happen, will choose freedom and will feel solidarity with the American people in the great testing time of the United States?

MOBILIZATION OF MANPOWER

MANPOWER

As this issue goes to press, the amendments to the Selective Service Act (S-1 and H.R. 1752), introduced by Senator Johnson on January 18,[1] are before Congress after more than a month of hearings before the Armed Services Committees. Most of the controversy in the hearings centered on the bill's provision for drafting 18-year-olds. Various compromise measures were suggested to tap other sources of manpower, but, while opposition to the measure is strong, no adequate substitute was evolved.

In the midst of this controversy, the question of the detailed mechanism for providing a continuous flow of trained specialists received little publicity, although there seemed to be general agreement that skilled scientific manpower was one of the nation's greatest needs.[2]

The Defense Department revised its enlistment procedures in an attempt to prevent "panic" enlistment of college students. College and high-school students whose induction has been postponed are to be given a 30-day period after graduation in which to enlist in the service of their choice. If the student has already been ordered for induction, the order will be cancelled if, during the 30-day postponement period, he applies in writing to his local board for such cancellation and notifies it that he wishes to enlist in a specified branch of the armed forces.

A second and more revolutionary departure was contained in the order granting all college students (whose statutory postponements terminate upon graduation) thirty days postponement after graduation in which they may obtain employment in essential industry and thus be eligible for deferment. This action has been taken to help meet the demand of defense industries for skilled manpower. The order applies to the 30,000 students graduated in February and to those who will finish college in June.

Mr. Wilson, director of Defense Mobilization, has appointed Dr. Arthur S. Flemming, president of Ohio Wesleyan University, as assistant in charge of manpower problems. He will preside at meetings of the Manpower Policy Committee, which will include: Mrs. Anna Rosenberg, Assistant Secretary of Defense, the Director of Selective Service, the chairman of the Wage Stabilization Board and representatives from the Department of Labor, the Department of Agriculture, the Civil Service Commission, and the Defense Production Administration.

WOMANPOWER

Presidents and deans of twenty-nine women's colleges called for a careful study by the federal government of the useful role that women can play in the present emergency. On February 5, in a letter to Mrs. Anna M. Rosenberg, Assistant Secretary of Defense, the educators said that "it would be a tragedy if the tremendous potentialities of women to serve their country should be underestimated at this time," and requested that women be encouraged to enter professional fields. The group was headed by Millicent C. McIntosh, dean of Barnard College.

[1] Provisions of the bill were outlined in *Bulletin*, VII (February 1951), 42, 64.

[2] See Thomas report, pages 89–93 of this issue.

THE THOMAS REPORT ON SCIENTIFIC MANPOWER

Below we print the text of the recommendations submitted on January 12 by the Scientific Manpower Advisory Committee of the National Security Resources Board. The NSRB is the government agency directly responsible for advising the President on the proper use of manpower. Four scientific bodies, the American Institute of Physics, the American Chemical Society, the Engineers Joint Council, and the National Research Council were asked by the NSRB in September 1950 to suggest procedures for the mobilization of scientists. The Barton Report (American Institute of Physics) was published in the December issue of the Bulletin. The various proposals from these societies were studied by the Thomas Committee in preparing the report now presented. The NSRB has submitted the report to the President, and Mr. Thomas has testified before a Senate subcommittee. As yet there is no evidence that it has had any influence on Congress. The only reference to the problem with which the report deals is the section of Senator Johnson's amendment (S-1) to the Selective Service Act, which stresses the importance of the "fullest possible development and utilization of technological and scientific manpower" and authorizes the President to permit a maximum of 75,000 students each year for the next three years, to return to school after their four-months' basic training to "engage in study or research in medicine, the sciences, engineering, the humanities, and other fields designated by him to be in the national interest." In an amendment submitted February 28 by Senator Morse, this number is raised to 150,000 a year, and the school assignment would count as military service. The members of the Scientific Manpower Advisory Committee, headed by Charles Allen Thomas, included six prominent educators: Chester I. Barnard, J. Douglas Brown, Vannevar Bush, Lee A. DuBridge, Gordon Gray, and J. C. Warner; four leading industrialists: Ralph Connor, Ben Moreell, Harry A. Winne, and Everette D. DeGolyer; and General Jacob L. Devers.

FOREWORD

IT IS of paramount importance to the security of the United States that the nation maintain in peace and in war an adequate supply of scientifically and technically trained manpower to carry on progressive research in basic science; to design and develop devices and equipment for both military and civilian use; to sustain, broaden, and increase mass production by scientific and engineering methods; and to serve the armed forces in applied science research, technical maintenance, and the use of modern weapons.

The Scientific Manpower Advisory Committee has considered the needs of the armed forces, the manpower requirements of essential industry, and the necessity of maintaining essential civilian services. The responsibilities of the committee relate to scientists, engineers, and other technical personnel. Throughout this report the words "scientific manpower" are intended to include persons in each of these three categories. Although no recommendations are made with reference to technicians, the committee recognizes their extreme importance in support of work at the professional levels.

It is the considered opinion of the committee that the "Plans for the Development and Use of Scientific Manpower" which follow serve the combined needs of the nation best—no matter how severe the immediate emergency becomes or how long it is protracted. In the case of a total war the details of the plan would undoubtedly be altered, but the main features will provide machinery that may be adjusted to circumstances.

STATEMENT OF PURPOSE

The objective of the committee is to propose a method by which an adequate supply of scientific manpower can be maintained and channeled most effectively into the armed forces, industry, education, and government.

In terms of gross numbers of men, the United States is inferior to its potential enemies. The last war, however, proved that weapons incorporating the latest developments in science and engineering, combined with fruitful research and mass production, gave this nation a marked advantage. The present problem, then, is to create a plan that will assure a continuing supply of men with special training, and to devise a method that will secure the best use of them as well as those who are already trained. The committee recognizes the following needs for scientific personnel:

1. *Military.*—Scientific manpower is needed for research, training, operations, and maintenance in the many phases of technological warfare.

2. *Industry.*—Scientific manpower is necessary for research relating to the design and development of products for both military and civilian use and for the rapid translation of new weapons, materials, and equipment into mass-produced finished products.

3. *Research.*—To be in the forefront of scientific advancement, the nation depends upon highly-trained people for research, both basic and applied—in industry, in government, in colleges and universities, and in research institutes.

4. *Civilian.*—Scientifically trained manpower is needed to further the work of education, agriculture, public health, civilian defense, and public welfare.

In preparing its plan, the committee recognized that the morale and productivity of the men concerned could best be protected by aggressive

prevention of misuse of their services rather than regimentation.

After study and deliberation, the committee believes that the following plan fulfils the purposes cited. While taking into account the military needs for an active force of more than three million men, the plan also establishes a means of creating, conserving, and using scientific manpower with the greatest over-all effectiveness—one of the most important factors in making the quality of American armed forces superior in strength to numerically greater forces.

THE BASIC PRINCIPLES

The two principles upon which any plan for obtaining the best use of scientific manpower should be based are:

1. Available scientific manpower should be judiciously distributed among those activities in which scientifically trained men can make the most effective contribution to the strength of the nation.

2. A continuous flow of adequately trained scientific manpower should be maintained from colleges and universities.

If these basic principles are violated, both the immediate build-up of strength and the nation's long-range mobilization potential will be jeopardized. At present these principles should be applied—particularly to the induction of men through selective service and to the recall to active duty of reservists.

The recommendations have to do with both of these matters and are based upon the premise of universal military service for all young men as they attain the age of eighteen. It is the belief of the committee that the needs of the armed forces are such that, except to meet the minimum requirements of the nation for specially trained people, these young men should serve in the armed forces for approximately a two-year period and then be free to continue their schooling or to enter vocations as they choose in the manner to which this country is accustomed.

The recommendations attempt to provide a means by which those minimum needs for trained manpower may be met, for a smooth transition into the period when this universal military service may become fully operative, and for the utilization of those trained in science, engineering, and technology, in such a manner as to give maximum strength to the nation.

RECOMMENDATION NO. I: ASSURING A CONTINUOUS FLOW OF STUDENTS UNDER MILITARY SERVICE

Part I—Long-Range Plan

Approximately a million youths reach the age of 18 each year. The number will increase substantially during the coming ten years. At present, young men reaching 18 are required to register with Selective Service but are not subject to induction until the age of 19.

Of the million per year reaching 18, it is estimated that under presently proposed standards approximately 800,000 will be found physically and mentally qualified for service in the military organization.

Any satisfactory universal training and service plan must provide that a reasonable proportion of young men continue their training to attain the higher scientific skills which are essential to the national strength. Only about 110,000 were graduated last year (all-time high) in all fields of science and engineering. Unless a suitable plan is devised, the flow of students receiving such training will be so sharply curtailed during the next two or three years as to be wholly inadequate to meet national needs. The gap resulting from an interruption could not be made up at any foreseeable time in the future. And further—

Even at that future time when the flow of students back to colleges and universities is resumed after they complete their twenty-seven months of military service, the training of certain superior students prior to military service is desirable in order to avoid the loss of two of their potentially most productive years.

To maintain a continuous flow of students being trained in critical scientific fields essential both to military and supporting civilian activities, the committee recommends the following plan:

1. All qualified 18-year-olds (plus 17-year-olds with parents' consent) should receive four months' basic training. Those who have not graduated from high school should be deferred until 19 or until graduation, whichever is sooner.

2. Upon completing four months' basic training, all trainees should be liable for military service, the total period of service and training not to exceed twenty-seven months. This period of service should begin immediately for all except a limited number who would so elect and qualify to be placed on inactive duty for:

a) Reserve Officer Training Corps (ROTC) enrolment at the college level. This group would provide a continuous supply of trained officers for military service, and it would encompass students in all fields of study including the scientific fields.

b) Reserve Specialist Training Corps (RSTC) enrolment at the college level. This group would provide a second, separate continuous flow of men, the most of whom would be trained in science, engineering, medicine, and other critical fields, and who would then be available for military and civilian activities essential to national strength.

3. Candidates for Reserve Specialist Training Corps should be selected by a board of competent educators with both civilian and military representation. Selection should be made on the basis of competitive examinations, adjusted by other indications of aptitude or attainment.

4. The size of the Reserve Specialist Training Corps should be reviewed periodically by a National Scientific Personnel Board (see Recommendation II) in the light of fluctuating requirements. At present, it appears that initially the number of annual entrants needed will be approximately 75,000.

After men who have not elected or qualified for RSTC or ROTC have completed their twenty-seven months of service and begin to flow back into colleges and universities, the initial number could undoubtedly be reduced. When the flow back becomes substantial, the policy of the National Scientific Personnel Board should be to meet national needs as far as possible by encouraging the further education of returning service men and to reduce the numbers in Reserve Specialist Training Corps accordingly.

5. Members of the Reserve Specialist Training Corps should be expected to remain in college and university training as long as their performance is satisfactory to the institution in which they are studying or until completion of undergraduate studies.

6. The fields of study open to members of the Reserve Specialist Training Corps should be primarily the fields of science, engineering, medicine, and others determined by the government to be essential to national security. Within the approved specialties, no attempt should be made to channel

students into detailed fields of study, or to prevent transfer of students from one college to another. Students should be permitted to take training at any accredited institution of higher learning appearing on the list published by the U.S. Office of Education, except as this list may be modified for its own purposes by the National Scientific Personnel Board. Each institution, however, shall be the judge of applicants admitted to it.

7. Upon completing undergraduate training, a number of graduates recommended by the National Scientific Personnel Board and determined by the President should be designated to undertake graduate training, providing each of them is admitted to graduate standing in an accredited institution.

8. All members of the Reserve Specialist Training Corps, upon completing either undergraduate or graduate training, should be liable for completion of the remaining portion of the training and service period of twenty-seven months. However, upon recommendations of the National Scientific Personnel Board and determination of need by the President, individuals completing Reserve Specialist Training Corps training may discharge all or part of their liability for military service by service in other activities essential to the national defense. In such case, the individual should be required to agree in writing to accept employment using the skills he acquired through Reserve Specialist Training Corps training in activities recommended by the National Scientific Personnel Board and approved by the President.

The 75,000 annual college entrants under this plan alone would still be inadequate to provide the required number of scientific personnel. Although this supply will be augmented by those who return to college after their period of military service there will still be a minimum number of superior students whose education should not be delayed by two years.

No stipend is recommended for men in the Reserve Specialist Training Corps. It is hoped that existing scholarships and loan plans will be sufficient to insure that no individual of high caliber will be denied educational privileges because of lack of personal funds.

Part II—Temporary Plan

Although the period of required basic training following induction is limited to four months, as proposed above, the time required to build up flows of men into basic training, to test, screen, and to release trainees to inactive duty and to admit trainees into college courses would involve an interruption of a year or two of the flow of students through college.

To avoid the loss of one or more college classes of scientists and engineers, and to help maintain a minimum flow of such students through the colleges until the long-range plan is in full operation, the following recommendations are made:

1. In addition to the flow of ROTC candidates selected by the armed services for admission to the freshman class in colleges in September 1951, there should be selected for the 1951 and the 1952 class, to the extent necessary, sufficient numbers of students with superior aptitude for college work in science, engineering, and premedical fields. This selected supplement will at least partially maintain the flow of students during the period before Reserve Specialist Training Corps students and those who have completed their twenty-seven months of service enter college. The selection should be made by a competitive examination open to those who apply. Examination performance should be modified by other indications of aptitude or attainment. The number of such students should be some reasonable fraction of normal enrolment. It is suggested that 75,000 would probably be adequate, although this number is less than the later aggregate of students in the Reserve Specialist Training Corps plus the still later group with service completed.

2. For the same reasons and in the same manner, a similar number of students now in their freshman year with special aptitudes in science, engineering, or pre-medical studies should be selected for continuance in college as sophomores in September 1951, in addition to those in ROTC.

3. The military training and service of such students should be postponed until completion of their undergraduate training so long as they remain in good standing in college programs of science, engineering, or pre-medical studies.

4. Since the students entering the junior and senior classes in September 1951 will have been screened by satisfactory completion of two or three years of college work and since the numbers of such students are by no means excessive to provide (*a*) ROTC graduates for the armed services, (*b*) other potential officer and technical non-commissioned officer material for the services, and (*c*) science, engineering, and pre-medical graduates for further professional training or employment in activities essential to national security, it is recommended that the military service of such students be postponed until graduation in 1952 and in 1953 provided they continue in good standing in their college programs.

5. Upon recommendation by the National Scientific Personnel Board and determination by the President, a number of graduates from this year's senior class, as well as in succeeding years, in scientific and engineering fields should be designated to enter graduate training. The selection of these students should be made under provisions approved by the National Scientific Personnel Board.

6. All trainees under this transitional plan, upon completion of either undergraduate or graduate training, will be liable for completion of the remaining portion of the training and service period of twenty-seven months. However, upon recommendation by National Scientific Personnel Board and determination of need by the President, individuals completing their training may discharge all or part of their liability for military service by service in other activities essential to the national defense. In such case, the individual should be required to agree in writing to accept employment using the skills acquired during training in activities recommended by National Scientific Personnel Board and approved by the President.

7. As in the case of students in the Reserve Specialist Training Corps, it is the belief of the committee that lack of personal funds need not prevent college attendance of trainees selected under this transitional plan.

RECOMMENDATION NO. II: ESTABLISHMENT OF A NATIONAL SCIENTIFIC PERSONNEL BOARD

At present there are about 65,000 scientists and engineers of age 25 or less. They represent less than one per cent of the civilian male population in this draft age group. A large fraction of these young men are already employed in work of vital importance to the nation, and more are needed. When the special skills which they possess are more urgently required by the armed forces, an adequate number of them should be inducted and assigned to the military specialty which will make the best use of their capabilities. But it is most vital that

these trained scientists and engineers are not removed from defense activities for service in non-specialized military assignments.

Determining which registrants possess scientific and technical competence and evaluating the importance of their present work is a job requiring highly technical judgments. The Selective Service System is neither organized nor staffed to establish the needed criteria. Nor do all local boards have the technical knowledge to use such criteria in making the judgments regarding individual registrants.

This selective service problem will gradually disappear under UMTS. As 18-year-old inductees complete their two years of service, they will be free to attend college or accept employment as they choose. This group, however, will have reserve status. Some will choose to enter college training in the science and engineering fields, and their talents should be fully utilized.

In addition, the utilization of scientific and engineering students out of Reserve Specialist Training Corps will raise special problems. Decisions will have to be made to determine which of these students should continue on to graduate study; how they should fulfil their obligation for twenty-three months of service; and, later as reservists, where they can contribute most in civilian or military assignments.

It is therefore recommended that a National Scientific Personnel Board be created immediately, that it be directed to function at the highest level in the Office of Defense Mobilization, (or in an integrated National Manpower Administration), and that it have the following organization and functions:

Organization

The National Scientific Personnel Board should be comprised of men of established eminence and integrity. While outstanding scientists and engineers should serve upon the board, members representing education, industry, research institutions, military and other highly significant points of view should also be included. The objective is to have a board that will bring to bear upon scientific manpower problems both a technically competent and broad national point of view.

As component elements of the National Scientific Personnel Board there should be created in appropriate regions of the country Regional Scientific Personnel Boards. The same criteria should be applied in the appointment of members of regional boards as are provided for the national board.

Functions of a National Scientific Personnel Board

1. To determine the available resources and to accumulate and analyze the requirements for scientific manpower of the armed forces and other activities essential to the national strength.

2. To define, identify, and classify the skills in science, engineering, and technology which are of special importance to national strength.

3. To develop the criteria for identifying and classifying persons possessing the above skills.

4. To advise on the number of scientific and engineering students to be selected for the Reserve Specialist Training Corps.

5. To receive the requisitions (other than the call-up of present reserves) of the armed services for scientific manpower and to allocate the requirements to regional boards for filling.

6. To receive requests for scientific manpower from government contractors and from other essential civilian activities for the purpose of securing the optimum distribution of available scientific manpower.

7. To hear and decide appeals filed by regional boards, by selective service, by individuals, or by employers.

Functions of the Regional Boards

1. To classify individuals possessing critical scientific and engineering skills who are liable for military service (1) through selective service, (2) as reservists who have completed their twenty-seven months of military service, or (3) as members of the RSTC whose twenty-three months of service have been postponed.

Individuals whose education, experience, or present occupation suggest them as possibly possessing scientific skills should be referred to regional scientific boards by local selective service boards. Such individuals may also be called to the attention of regional boards by the individual himself, his employer, or other interested parties. The finding of a regional board that a selective service registrant possesses a critical scientific skill should be controlling upon the local selective service board to assign such registrant a deferred classification. However, local selective service boards and other interested parties should be permitted to appeal through channels to National Scientific Personnel Board. The Department of Defense should not enlist or commission registrants placed in deferred status on request of a regional scientific board, except by agreement with the National Scientific Personnel Board.

2. To fill the requisitions of the armed forces for scientific and technical manpower from:

a) Registrants of selective service.—The regional scientific board would determine which registrants may be inducted, and the local selective service boards would then perform the inductions. All individuals classified as being inducted under the purview of scientific personnel boards should be so designated in selective service board quotas.

b) Members of RSTC who have completed their college training.—The regional boards should recommend to the National Scientific Personnel Board those cases in which the national interest requires that an individual's twenty-three months service, or any portion thereof, be performed in civilian status.

c) Persons in reserve status who have complete twenty-seven months of service.—Those classified as possessing scientific and technical skills should not be called to active duty if it is determined by the President, upon recommendation of the National Scientific Personnel Board, that they can and will perform duties of greater importance to the nation in a civilian capacity.

3. To appeal actions of local selective service boards if those actions are believed to be inconsistent with the policies of the National Scientific Personnel Board.

4. To recommend to the National Scientific Personnel Board those members of the RSTC who shall be designated as candidates for studies at the graduate level.

RECOMMENDATION NO. III: ESTABLISHMENT OF SPECIAL PROVISION FOR HANDLING PRESENT RESERVISTS POSSESSING SCIENTIFIC AND TECHNICAL SKILLS

A most serious problem in the immediate build-up of national strength is the proper utilization of large numbers of scientists and engineers who now possess military reserve status. The creation of a National Scientific Personnel Board does not solve the problem of obtaining the maximum

value from this trained manpower, particularly so when their reserve status is not cognizant of the technological skills many have developed since entering the reserve. The danger of loss is particularly acute if the present machinery of mobilization removes them from occupations which upon examination proved to be more valuable to national defense than their projected military assignments.

Because of G.I. training privileges, the lapse of time since their last active duty, and obsolescence of certain military specialties — indiscriminate call-up, much more than ever in the past, would blunt their effectiveness in the military and would impede industrial mobilization. Large numbers of these present reservists are key figures in research, industrial development, production, and education. The solution of this problem is the responsibility of the Department of Defense.

It is therefore recommended that the Department of Defense immediately establish at the highest level of authority special machinery with the following functions:

1. To develop armed forces policies and programs by which the call-up of reservists (of all the services) will be reconciled with the needs for scientific manpower for essential educational, research, and production activities.

2. To hear and act on appeals from call-ups by the respective services. These appeals should be authorized to originate from individual technologists or their employers.

3. To set up a program by which employing establishments can obtain clearance on reservists. This involves creating a single point of contact with whom employing establishments can review in detail their needs for retaining reservists in their organizations.

4. To clarify to employers the importance of their notifying the armed services of their needs for specific reservists in order that final decisions regarding calls to active duty may be made on the basis of all of the facts that can assist in determining how each individual will contribute the most.

5. To develop a policy relative to calling up present reservists who are advanced undergraduate or graduate students in critical fields, to act on appeals initiated by such students or by their institutions, and to assist in seeing that deferred students, when called up on completion of their studies, use their skills in a manner which makes the greatest contribution to national security.

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6. To reconcile inter-service competition for specialists who are employed by suppliers and agencies of one service and in the reserve of a different service.

The resolution of the problem of obtaining maximum use of the large pool of scientific manpower now in the reserves of all services and under the jurisdiction of the military can only be initiated by the Department of Defense.

The committee urges that thorough consideration be given the problem. Its solution is of vital interest to contractors for military supplies, civilian research and development groups, industries which serve the civil welfare, and educational institutions. It is recommended that these interests as well as the Office of Defense Mobilization be represented on whatever board or other group is created by the Department of Defense for this purpose.

CIVIL DEFENSE NEWS

Prepared by Clyde A. Hutchison, Jr.

PROGRESS IN THE STATES

BEFORE the outbreak of the Korean war, only sixteen states in the U.S. had appointed civil defense directors; nineteen states and one territory had neither civil defense legislation nor executive direction through which plans could be financed and implemented. No legislation had been passed enabling states to set up mutual assistance pacts in the event of emergency.

Today every state has a full-time director with authority to act by legislative or executive order. Four states have passed civil defense acts in the 1951 sessions of their legislatures (one of the four, Alabama, holding a special session for this purpose). Acts are now pending before twelve state legislatures, and amendments to existing legislation are being considered in five states.

In preparing a survey of the legislative and financial status of civil defense programs in the states, the *Bulletin* requested information from the forty-eight state directors. The information received is shown in Table 1 and in the list of appropriation figures.

In the case of fourteen states from which no personal communications were received, information has been supplied from the survey published in *State Government*, XXIII (November 1950), 237 ff.

TABLE 1
CIVIL DEFENSE LEGISLATION IN THE STATES

LEGISLATION PASSED IN 1951	LEGISLATION ENACTED IN 1949–50	WORLD WAR II (LAWS STILL IN FORCE OR REACTIVATED)	PLANNING LAUNCHED BY EXECUTIVE ORDER
Alabama	California	Arizona	Arkansas†
Georgia	Colorado*	Delaware	Illinois†
North Carolina	Connecticut	Florida§	Kentucky
Wisconsin	Indiana	Idaho	Minnesota†
	Louisiana	Kansas†	Mississippi
	Maine	Michigan	New Mexico†
	Maryland	Missouri†	North Dakota
	Massachusetts	Nevada*	Oklahoma
	Montana† (Disaster Relief Act)	Utah†	Pennsylvania
	Nebraska†	Virginia	Tennessee†
	New Hampshire	Washington†	Texas†
	New Jersey‡	West Virginia*	Wyoming
	New York		Panama
	Ohio		
	Oregon		
	Rhode Island		
	South Carolina		
	South Dakota		
	Vermont		
	District of Columbia		
	Hawaii		

* Amendments now pending before legislature.
† Civil Defense Act now before legislature.
‡ Bill to empower governor to make mutual assistance pacts with neighboring states now before legislature.
§ Act prepared for April 1951 legislature.

STATE APPROPRIATIONS FOR CIVIL DEFENSE

Alabama—$200,000 until September 30, 1951.

Arkansas—$10,000 allocated from governor's emergency fund; $129,200 asked in budget for biennium, which includes $75,000 for emergency maintenance.

Colorado—$20,000; additional appropriations being requested.

Connecticut—$75,000 to June 1951; budget recently submitted to state legislature.

Florida—$30,000 contributed from state agency funds for interim period until legislature meets; budget prepared asking $133,000 annual administrative appropriation, with contingent fund of $200,000 for emergency. Supplementary budget prepared calling for $5,000,000 for matching purposes under Public Law 920.

Georgia—$200,000 for fiscal year 1952.

Illinois—None at present. Will be sought at present session of legislature.

Kansas—Appropriation bill asking ten cents per capita for coming year pending in legislature.

Kentucky—$10,000 diverted for civil defense from governor's emergency fund.

Louisiana—$50,000.

Massachusetts—$150,000.

Minnesota—$30,000 emergency appropriation.

Nebraska—$100,000 emergency appropriation passed January 1951.

Nevada—None at present. Act before legislature.

New Hampshire—$15,000 provided for administrative expenses from governor's contingent fund for last six months of 1950; $23,000 for first six months of 1951.

New Jersey—$8,300; administration bills to appropriate $250,000 for immediate operating expenses pending.

New York—Between July 10, 1950 and March 31, 1951: $220,000 for personal services, maintenance and operation; $500,000 to Department of Health for

(*Continued on page 96*)

NEWS IN BRIEF

Prepared by PETER AXEL

ATOMIC WEAPONS TESTS

In a display of atomic preparedness, the Atomic Energy Commission completed a series of five atomic explosions in eleven days. The explosions occurred on January 27, 28, February 1, 2, and 6. The scarcity of public information on these tests was explained by the Chairman of the AEC, Gordon Dean, in a press conference on January 30:

"We have been very careful not to divulge to the Russians by anything we might say or reveal . . . anything that would indicate the nature of these demonstrations. . . . We do not propose to reveal even after these detonations are over the nature of them or the success or failure of them, or what effects the experiments will have on our total atomic strength. . . . We have agreed, therefore, that the only thing that our people are going to say . . . after it has been learned that a detonation has taken place is . . . 'One of the periodic tests announced by the commission on January 11, 1951, was held.'. . . This seems awfully abrupt, but I think if you were aware of all of the information that we would be giving if we went much beyond that, certainly, you too, would come to the conclusion that that is about all we can say."

Mr. Dean did make a further statement about the nature of the (first two) explosions which was responsible for much speculation and confusion about "baby A-bombs" in the press. He said "I don't think that it is fair to call it a bomb. These are essentially . . . experimental detonations, nuclear detonations. Now that sounds rather cumbersome, but I think that qualifying language is useful." While the meaning of Mr. Dean's statement is obscure, neither it nor any other official public announcements implied that weaker, less destructive atomic bombs were being made. An atomic explosion presumably still requires that at least the "critical mass" of fissionable material be confined in a small volume. If the mass were not well confined, a very inefficient explosion might occur, but the same amount of material could produce the destruction normally associated with an A-bomb. It is quite conceivable that the AEC knows how to make smaller and lighter bombs, since most of the size and weight of the first bombs were due to the mechanism for forcing the critical mass into a small volume and confining it there. It might also be expected that the AEC has been able to produce more efficient and therefore more destructive bombs. Progress in the techniques of producing atomic explosions may have made it feasible to use atomic bombs in artillery shells or guided missiles. For example, on February 9, at a news conference, General J. Lawton Collins said that it may be "only a matter of time" before the army will have atomic weapons for "strategic use in the field." However, it is extremely doubtful that the AEC would consider it an achievement to use the "critical mass" of uranium or plutonium inefficiently, thereby wastefully producing a "baby" explosion.

INDUSTRIAL ATOMIC POWER PLANT

In recent months the U.S. Atomic Energy Commission has received proposals from two industrial groups expressing willingness to bring their technical resources into the atomic energy program under arrangements in which a large share of initiative and responsibility would rest with the industrial group.

Both of these groups would study the feasibility of developing and operating nuclear reactors for the production of plutonium and with the ultimate goal of producing electric power. One proposal was presented by Mr. C. A. Thomas, executive vice-president of the Monsanto Chemical Company; the other by Mr. J. W. Parker, of the Detroit Edison Company and Mr. M. E. Putnam, of the Dow Chemical Company.

The commission has discussed these proposals with the men who created them, and has suggested conditions under which it would be willing to go forward with the first step involved in each proposal—a study of its reactor development program by qualified technical groups from the industrial concerns involved. These groups will consist of ten to fifteen individuals. The AEC has announced the following general policy which has guided their consideration of these proposals:

"The commission will undertake cooperative activities with industrial concerns or groups of concerns to explore possibilities for their participation—on their own initiative, using their own resources—in development of applications of atomic energy for power purposes in such manner and extent as to insure: (1) maximum attention to the atomic energy production program in all its phases; (2) special effort being placed on those matters that will be productive in the relatively near future (one to three years); (3) the application of the best available brains to all the important problems of the commission.

"To guide the general manager and staff in considering further proposals in this field from industrial concerns or groups, the commission has specified that those submitting such proposals should put forth a well-defined set of objectives for their proposed study, should be financially responsible and equipped with a staff of adequate qualifications and size, and should undertake to submit a report including detailed findings and recommendations at the conclusion of the study. These reports would be disseminated at the discretion of the commission to the extent consistent with security.

"The commission has also directed that no commitment be made at this time to continue beyond the study phase. If satisfactory arrangements can be made for proceeding with these studies, the commission will make available to properly qualified and cleared persons existing information and a reasonable share of the time of commission personnel."

On February 2, Dr. Thomas announced that Monsanto was ready to undertake a study which would have the following four objectives: (1) Determine if sufficient materials and design information exist to permit the

design and construction of a nuclear reactor that would produce both plutonium and electric power; (2) Determine if such an atomic furnace could make electricity economically if the plutonium were bought by the government at a price equal to or less than its present manufacturing cost; (3) Recommend any additional research and development work required for the power reactor; (4) Set up the basic design premises for such a reactor.

By February 7, Monsanto Chemical Company announced that it already had started gathering a staff. The entire cost of the study will be borne by Monsanto, which is willing to include any other interested industrial concerns as partners. Dr. Thomas outlined two steps which would follow a successful study: "As step 2, the syndicate would design the power and plutonium plant at its own expense, ready for the constructors to start. The power plant might be of about 75,000 kilowatts capacity.... Step 3 would be to build the plant. That's the hardest thing for the AEC to swallow. But the whole operation of the plant would be under guard, and if something went wrong the commission could shut down quickly simply by stopping the entry of uranium."

The most likely uses of such a plant would be for chemical production, such as phosphorous, chlorine or calcium carbide, at sites distant from cheap power sources.

SECURITY

President Truman has established a Commission on Internal Security and Individual Rights to be composed of nine members and headed by Fleet Admiral Chester W. Nimitz. Describing the scope of the new commission's activities, the President said that it would consider the question of how this nation can best deal with the problem of protecting its internal security and at the same time maintain the freedoms of its citizens. It will make a thorough examination of the procedures concerning the protection of the nation against subversive activities and consider the methods used by public or private groups.

"One of the important matters for the commission to consider is the operation of the government employee loyalty and security programs," he said. "I wish to make it clear, however, that this commission is not being established as an appeals tribunal for individual cases. The commission will be expected to report on the effectiveness and fairness of the government's loyalty and security programs."

EXPOSING "INADEQUATE" SECURITY?

Chicago news commentator, Paul Harvey, who had been a critic of the "inadequate" security procedures at top secret laboratories was caught while attempting to make an unauthorized entry at Argonne National Laboratory. After Mr. Harvey was found climbing over a fence, he was questioned, but not detained, by the FBI. United Press reported on February 9 that Mr. Harvey claimed to have been working with investigation divisions of several federal departments. There have also been reports that the news commentator was simply trying to test the guard system so that he could report any laxity. Two Argonne guards were suspended in connection with the case. Senator McMahon stated that his Congressional Atomic Energy Committee would be given a full report and would issue a statement "if the facts warrant it."

RADIOISOTOPES

Brookhaven National Laboratory announced on February 1 that it was prepared to sell irradiation service and thereby supplement the isotope production activities of Oak Ridge National Laboratory. Brookhaven's facilities are available to anyone who requires the higher neutron flux (4×10^{12} neutrons/cm^2 sec) or to local isotope users who would benefit from savings in transportation time. The irradiation charge is proportional to both the flux and the irradiation time and is $10 per day in the maximum flux; there is an additional handling charge of $25 per irradiation.

AEC APPOINTMENTS

Walter J. Williams was advanced from the post of director of production to that of deputy general manager, succeeding Carleton Shugg who had resigned to join the staff of Electric Boat Company. Mr. M. W. Boyer, general manager of the AEC, also announced the promotion of R. W. Cook from manager of Oak Ridge operations to director of production. Mr. S. R. Sapirie, who had been Mr. Cook's assistant at Oak Ridge, replaced him there.

APPOINTMENTS

On February 15, Lloyd V. Berkner became the first full time president of Associated Universities Inc., the corporation established by nine eastern universities to administer Brookhaven National Laboratory. Mr. Berkner recently received widespread recognition for the report he wrote as a consultant to the State Department, *Science and Foreign Relations.*[3]

George B. Pegram, of Columbia University, was chosen as the chairman of the board of trustees.

ATOMIC COOPERATION WITH BRITAIN

New atomic energy agreements between Britain and the United States were reported to the House of Commons by Prime Minister Attlee on January 30. While Mr. Attlee neither discussed the equal partnership arrangement which existed during World War II nor the new agreement, he made it clear that there was no longer a complete exchange of information. It is reported that more engineering data on atomic weapons will be released by the U.S. to Britain and Canada.

[3] A condensation of this report was published in the October 1950 *Bulletin.*

STATE APPROPRIATIONS FOR CIVIL DEFENSE

(*Continued from page 94*)

stockpiling medical supplies; $50,000 miscellaneous for associated departments and agencies of the state.

North Carolina—$75,000 per year, operational, with contingency.

North Dakota—$10,000.

Oregon—$25,000.

Rhode Island—$10,000.

South Carolina—$10,000.

Utah—Appropriation bill to provide funds for next biennium now before legislature.

Washington—Proposed biennium administrative budget, $258,000; contemplating $5,000,000,000 contingency fund under control of governor.

West Virginia—Budget of $33,180 administrative funds and $1,000,000 emergency fund before current legislature.

District of Columbia—$100,000.

Hawaii—$25,000.

The following states either made no appropriations for civil defense purposes or, in the case of those marked with an asterisk, failed to reply to the request for information: Arizona, Delaware,* Idaho,* Indiana,* Iowa,* Maine, Maryland, Michigan,* Mississippi,* Missouri, Montana, New Mexico, Ohio,* Oklahoma, Pennsylvania, Tennessee, Texas, Vermont,* Virginia,* Wisconsin, Wyoming.

MINUTES TO MIDNIGHT

The International Control of Atomic Energy

Edited by EUGENE RABINOWITCH
Foreword by CARLOS P. ROMULO

THE *Bulletin of the Atomic Scientists* announces the publication of this 128-page book on the most crucial problem of our time: The International Control of Atomic Energy. Month by month, since its inception in 1945, the *Bulletin* has followed the attempt by the United Nations to find a way to secure the world against the threat of atomic warfare. It has published the important documents from the Truman-Attlee-King Declaration to the latest U.N. resolutions. It has carefully condensed the various plans for international control—the Acheson-Lilienthal Report, the Baruch Plan, the Soviet Proposals—summarized the reports of the United Nations Atomic Energy Commission, reported the debates with objectivity, and presented significant articles on the subject by leading scientists, statesmen, and political scientists. In MINUTES TO MIDNIGHT these documents and articles are gathered together in convenient form to give a complete, authoritative and unbiased account of the control negotiations. The Introduction and commentary is written by Dr. Eugene Rabinowitch, editor of the *Bulletin*. The material was selected by the Social Science Staff at the University of Chicago.

The purpose of MINUTES TO MIDNIGHT is to acquaint people with the actual course of the negotiations, with the large areas of agreement already reached, and with the true character of the disagreements which have obstructed this search for sanity.

MINUTES TO MIDNIGHT is of especial interest to
Study Groups concerned with the Great Issues of our time; Leaders of Forums and Round Table Discussions; Club leaders; College and University classes in the Social Sciences, etc.

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